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73

Amateur Radio's Technical Journal

A Wayne Green Publication

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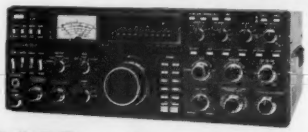

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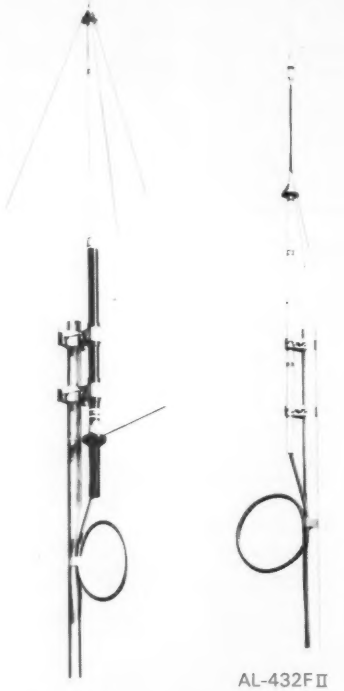

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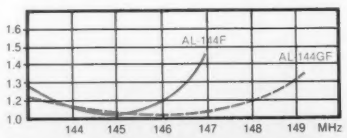

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editorial by Wayne Green

THE DAYTON DAZE

Two of the manufacturers exhibiting at Dayton were in a heated argument as I passed by, with one holding that the Hamvention officials were lying through their teeth about the attendance... that there certainly were no more than 27,000 hams there instead of the 30,000 official count at that time. Well, during the rainy early Saturday morning, I'll tell you this: You could hardly move from one place to another.

Once the sun came out, the hordes poured into the flea-market area and eased the pressures a tad. It was still crowded inside, but at least you could move around.

After trying to communicate with a packed roomful of people last year, fighting the thunderous noises from the two adjacent meeting rooms and what seemed like 100° heat and humidity, I wasn't even going to try this year. But the Hamvention people suggested I give it another try in a more isolated room... and at a more isolated time. So I got up there on the podium Friday afternoon, before many of the brethren had yet arrived for the hamfest, and did my stint. It was better, but still marginal. Next year, I'm told that there will be some new meeting rooms where we'll have quiet.

Since many of those present indicated that they preferred a stiff code test as part of our amateur entry fee—never mind what the lack of growth has done to our country, with the loss of one consumer electronics industry after another, a loss getting up into the dozens of billions of dollars a year... and never mind what this is doing to us in the way of military weakness (it's better to lose the country than acknowledge the changes in technology and cope with them)—keeping that in mind, I came out strongly in favor of Morse code and was met with great enthusiasm.

Fine... let's by all means go with what everyone wants, no matter how destructive it is. Let's make it so that we put our licenses where our mouths are ...if code really is important, then let's make sure that each and every ham has to requalify every year and prove the ability to copy.

None of this silly five words per minute. *That* isn't code! That's baloney. The ability to copy code starts at 13 per, so that should again be made the irreducible minimum. That should be the starting speed. But then, remembering that we are now agreeing that code is of high importance, can we honestly support anything other than a new "incentive licensing" plan which will move us on up to at least 35 words per minute? Any ham really worthy of being a ham should be able to get to that speed in a few weeks... so let's set that as the ticket for holding your license.

Many of those present were nodding eagerly in total agreement, licking their chops at the thought of being able to knock 90% or more of the hams out of the hobby and back into CB where they belong. When I suggested 50 wpm for everyone, they were wildly enthusiastic. That could easily knock out 98% and QRM would be a thing of the past. Good grief, we might even have enough room so that we could go back to spark!

A couple of spoilsport women, obviously too lazy to really care about being hams, got mad over this and stormed out of the room. They probably never learned the code anyway... being licensed by a good friend who overlooked that little requirement.

The talk was fun.

In looking around the exhibits, I noticed that good old Bash was there, but everyone was giving this booth a wide berth. There were even some chaps talking about a "trash Bash" move to stop this prostituting of the ham ticket. And not a few hams came to me wondering what all the fuss about no-code was when with the new Bash code tapes one could pass the code test without even being able to copy the code. I had a good friend who got his Extra ticket that way. He had only slight ability to copy code... and virtually no theory understanding. He just wanted to see if one could Bash one's way to success without knowing a damned thing and was greatly surprised when he walked out with a lovely one-letter call suffix.

The development of ever smaller Morse-code readers has brought us to the tiny hand-held decoder. With that, anyone can copy code at almost any speed... certainly up to around 100 words per minute. If we can take that in with us for the license exam, that should solve the whole code problem... right? Oh, I can hear the purists bitching... "Yes, but what if the battery burns out?" We heard the same complaint when kids started using hand calculators instead of learning their multiplication tables. The answer to that is so simple: *solar power.*

They have inexpensive solar power cells which can run the decoder just from the glare of a Morse-code fanatic's eye. So

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QSL OF THE MONTH

This eye-catching card from Lalo Santos HK3EQJ in Bogota, Colombia, easily outshined the competition to win this month's QSL card contest. This colorful card features a modernistic shack resembling Mission Control, a motif which is reinforced by the large dish in the background and a quad antenna which literally sparkles. Further back, the stars shine over a haloed sun setting into the Andes mountains—a scene which would be beautiful from any shack.

If you would like to enter *73*'s QSL of the Month Contest, enclose your card in an envelope and send it to *73*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries without an envelope or book choice will not be considered.

let's stop worrying about the code, okay? It has turned out that kids do just fine without memorizing the multiplication tables. Those calculators don't wear out much...and solar power keeps 'em charged.

Speaking of the code, for those who think the code can be fun, AEA has a new gadget which will drive you crazy. They showed the first version of it last year at Dayton and this little bugger simulates a CW contact with you. Now they've updated it and you're in there fighting with a bunch of other stations trying to work some rare DX...all done by computer. I see this as a great gadget for hamfests to use for simulated DX contests. Hotshot DX ops can sit down at a DX simulator and see what kind of a score they can make in ten to twenty minutes of operating. That should be a ball.

With more and more of the CW ops using keyboards and code copiers, unless we stress the fun of the code, we may find that few, if any, hams are actually able to copy the code anymore. Almost all of the high-speed CW you hear on the bands these days is computer-generated and -copied. The Novice bands still have a few people hanging around chirping out half-hour CQs, hoping that no one will answer.

OTHER DAYTONIA

Out in the outer fringes of exhibitors, I was surprised to find a booth run by the CIA. It seems they are pepping up their communications facilities and are in need of technicians. I've got some pretty good friends who went into this kind of work and they've certainly had interesting lives as a result. If you're the kind of person who likes to travel and see unusual places, this might be worth checking out.

Icom was wowing 'em with their 1200-MHz repeater. It's set up for FM use, but I'll bet if they modify it a bit so that it will handle television, they'll have a bunch of customers. Ham television really should be up on 1200 MHz and not crammed onto one channel on 420 MHz.

And both Kenwood and Yaesu had new rigs which were showstoppers. You'll be seeing reviews of 'em here as soon as we can get our mitts on the rigs to check them out. Ten-Tec had a nice little 2m HT which I suspect is going to be very popular. We've been promised one of those soon, too.

The Hamvention is always a seething mass of hams going around the exhibits and then scouring the enormous flea market for bargains. If the show gets any bigger, I don't know where they could put it. The poor old Hara Arena in Dayton is just plain overwhelmed. Cars fill almost every neighboring field and the huge lots at the arena and line the streets for almost a mile around. The people in the neighborhood are uptight over the cars, but when about 30,000 hams descend on one place, it takes a lot of parking to handle 'em.

There was some sort of hassle over the flea market not being opened on Friday and a good deal of flak went up over that. And just to make the situation worse, the opening on Saturday was accompanied by a deluge. It cleared off in the afternoon just fine, but there were an awful lot of very unhappy fleas for a while.

Ohio has a new law aimed at getting tax payments on sales by flea-market exhibitors. This is mainly for the few professional flea-market salespeople who make a living at it and have been thus avoiding paying the stiff Ohio sales tax. The Hamvention crew shelled out $5 each for the flea-market exhibitors to keep the authorities off their backs. I think they remembered the problems at Rochester, where the police came in and virtually closed down the flea market... and the regular exhibitors, too. That disaster almost ruined the Rochester Hamfest, which has been struggling to get back to strength ever since then.

For a show of its size, the Hamvention went very smoothly. It's three days long and it takes you that much time to really see just the inside exhibits, much less cover the flea market...which had about 600 exhibitors this year, I understand. Nine in the morning until eight at night is a grueling job for the poor exhibitors, but perhaps it's worth it so that everyone has more of a chance to see everything. It's only once a year.

REAL HAMS

One thing the mail about the proposed code changes has made crystal clear is that there still are a substantial number of Real Hams around, despite the decimation of our ranks by what the communists called "incentive licensing."

For instance, the Real Ham does not use sideband...that's for wimps. The Real Ham sticks to the Real Ham communications mode: CW. Oh, the Real Ham gets on two meters, too, but no Real Ham signs his call more than once every half hour or so. After all, the Real Ham only talks to damned good friends...other Real Hams... and everyone knows who's who by the voices, so who needs an ID? The more often you sign your call, the more of a wimp you are. And no one but a leaping faggot would prissily demand that the breaker identify himself.

Real Hams, when they develop Parkinson's Disease, which a growing number of them have, and can no longer make that old straight key talk, do go on phone...but you can be damned sure they go on AM, not wimpy sideband with the ducks and other fruits.

Real Hams have a key in one hand and a six pack of cool 807s by the other. They eat pretzels while hamming and steak and potatoes for dinner. Pringles? You've got to be kidding! You ought to have your keying hand mashed in the door for even thinking such an obscene thought.

DANGEROUS DXING

Alas, I didn't see any mention of amateur radio in the news reports of the ill-fated Spratly DXpedition. You've probably read about it. It had to do with a group of German DXers heading to Spratly on a catamaran. They unfortunately managed to find the islands and were shot out of the water by the Vietnamese, who killed one of the DXpeditioners. The other five drifted for nine days in a dinghy, with one dying of dehydration before the rest were picked up.

As I recall, the last bunch of DXers who tried to get Spratly off the endangered DX list got shot at, but not with quite such disastrous results. You'd think that DXers would take a look at history before going to Spratly.

The first ham to put Spratly on the air, back in the 60s, the chap who invented the 1S call (much to the annoyance of the ITU), figured out how to get all the contacts he wanted from there without all that danger. As far as I know, he did his entire Spratly exercise from up in central Thailand, the same place he used to make his Burma and Cambodia exercises, I suspect. I have the cards from those operations and they are acceptable for DXCC.

DXpeditioning used to be a lot easier...and more fun...when the ARRL didn't put hams in danger of their lives. No one really gave a damn whether the DXpedition was exactly precisely where it claimed to be or not.

Continued on page 124

TEN-TEC

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Cleanliness in the TEN-TEC CORSAIR means unusual spectral purity of both received and transmitted signals.

In Receive mode, even with the r.f. preamp in operation, the 3rd order intercept (at 20 kHz tone spacing) is +5 dBm. With the preamplifier off, the 3rd order intercept rises to a superlative +18 dBm and remains constant even at 3 to 6 kHz away from the pass-band.

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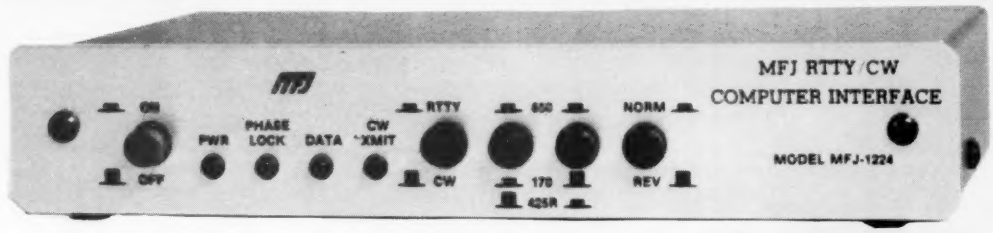

- *Copies on both mark and space tones.*
- *Plugs between rig and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most other personal computers.*
- *Uses Kantronics software and most other RTTY/CW software.*

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MFJ-1224

This new MFJ-1224 RTTY/ASCII/CW Computer Interface lets you use your personal computer as a computerized full featured RTTY/ASCII/CW station for sending and receiving.

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You can also use most other RTTY/CW software with nearly any personal computer.

A 2 LED tuning indicator system makes tuning fast, easy and positive. You can distinguish between RTTY/CW without even hearing it.

Once tuned in, the interface allows you to copy any shift (170, 425, 850 Hz and all shifts between and beyond) and any speed (5 to 100 WPM on RTTY/CW and up to 300 baud on ASCII).

Copies on both mark and space, not mark only or space only. If either the mark or space is lost the MFJ-1224 maintains copy on the remaining tone. This greatly improves copy under adverse conditions.

A sharp 8 pole active filter for 170 Hz shift and CW allows good copy under crowded, fading and weak signal conditions. Uses FET input op-amps.

An automatic noise limiter helps suppress static crashes for better copy.

A Normal/Reverse switch eliminates retuning while stepping thru various RTTY speeds and shifts.

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In addition to the Kantronics compatible socket, an exclusive general purpose socket allows interfacing to nearly any personal computer with most appropriate software. The following TTL compatible lines are available: RTTY demod out, CW demod out, CW-ID input, +5 VDC, ground. All signal lines are buffered and can be inverted using an internal DIP switch.

For example, you can use Galfo software with Apple computers, or RAK software with VIC-20's. Some computers with some software may require some external components.

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It plugs between your receiver and VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64 and most other personal computers.

It uses Kantronics software which features CW receive 5-99 WPM, RTTY receive 60,67,75,100 WPM, and ASCII receive 110, 300 baud, plus more.

An automatic noise limiter helps suppress static crashes for better copy, while a simple 2 LED tuning indicator system makes tuning fast, easy and positive.

In addition to the Kantronics compatible socket, a general purpose socket provides RTTY out, RTTY inverted out, CW out, CW inverted out, ground and +5VDC for interfacing to nearly any personal computer with most appropriate software.

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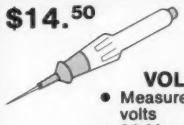

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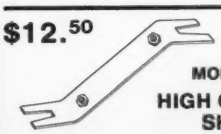

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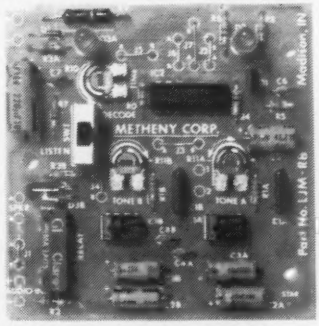

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You Can Build This Code Trainer

More than a mere code-practice oscillator, this CPU-controlled trainer features burned-in practice groups. Flick a switch and you have a keyer.

If you are a ham who wants to upgrade or a ham to be, or if you know someone who wants to be a ham, there is now a low-cost, single-chip microcomputer for you. It is called the CPP1. The CPP1 is a single-chip microcomputer that contains copyrighted software for teaching Morse code. It also doubles as an electronic keyer (iambic) for added versatility.

The unit can be built in one evening. This makes it ideal for the time-pressed person who would rather be involved with amateur radio than with computer technology. Virtually everything is contained on the chip except the dot clock and the tone generator. These are built around the low-cost 555 timer chip.

Learning Morse code using tapes and records is a frustrating experience. It's difficult to concentrate when you have to keep stopping and rewinding to the beginning of a particular practice group. Also, tapes and records never seem to have the right speeds to practice at. They are either too fast or too slow.

Personal computers are far better. However, their cost is a problem, especially

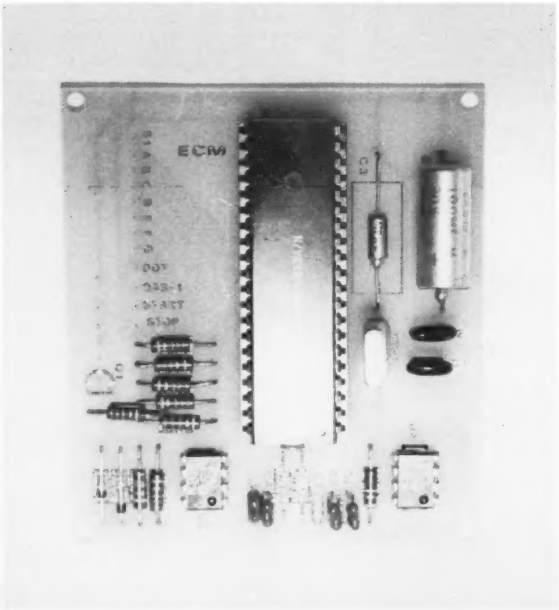

Photo A. The CPP1 circuit board.

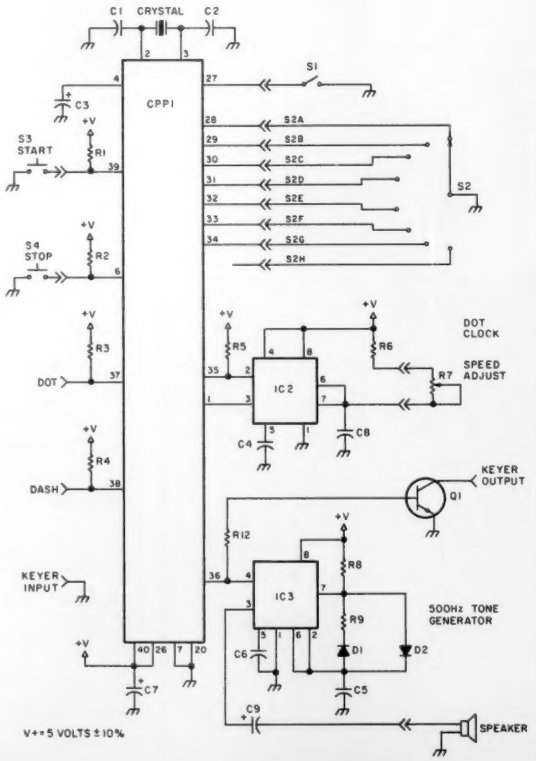

Fig. 1. Schematic.

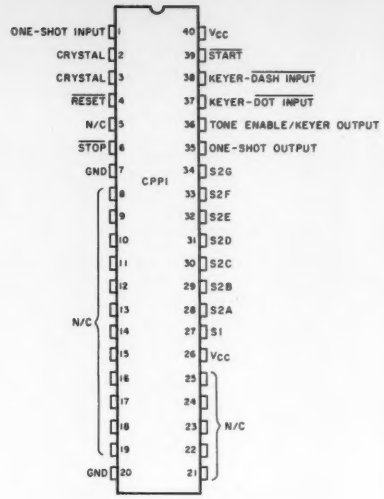

Fig. 2. Pin description.

if your budget is tight. In addition, most people do not have the technical or software knowledge to make this approach viable.

The CPP1 solves both of these problems. The chip contains 15 practice tables. They are organized to provide for ease of learning. When a particular table is selected, it will repeat until the user decides to move on. Speed is virtually unlimited, however; with the components called out later, the processor will send perfect code from 2 wpm to over 40 wpm. Finally, it is simple to use. No need for a degree in computer sciences to use it; just select and go.

Circuit Description

The heart of the code trainer/keyer is the CPP1. Contained in this 40-pin package are 128 bytes of RAM, 2K of ROM, an 8-bit CPU, a reset circuit, a clock, and predefined I/O ports. It is a true system on silicon.

To get the CPP1 to function requires a simple crystal/capacitor addition to pins 2 and 3 of the processor (see Fig. 1). The crystal can be from 1 to 6 MHz. A 3.57-MHz color-burst crystal is recommended because of its availability and low cost.

In order to ensure proper start-up, the chip contains a reset circuit that holds the processor in a known state until power is stable. The chip must stay reset for at least 50 milliseconds. This is accomplished by capacitor C3 on pin 4 of the CPP1. When power is applied, the capacitor will hold this line low. An internal pull-up resistor will then start charging the capacitor. When the capacitor reaches a high level, the processor function will start.

The processor at this time will set the I/O ports up per its internal program. It will then start testing the start button for a closure (pulled to ground). When a valid switch closure is recognized, the program will next test switch S1 to see if it is open or closed.

Switch S1 determines which table is to be executed (see Tables 1 and 2). If switch S1 is open, Table 1 will be selected. If switch S1 is closed, Table 2 will be utilized.

Next, the processor will test switch S2 to determine which subgroup to run. There are a total of 8 subgroups per selected group. Seven require that one of the pins, 28 through 34, be pulled to ground through switch S2. The eighth group is selected when all eight pins are open.

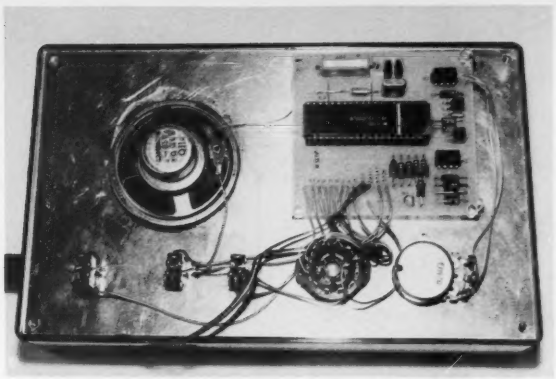

Photo B. The inside top panel of the CPP1.

Upon determining which subgroup has been selected, the processor will start sending at the rate of the dot clock, IC2. All timing is based on the dot clock.

The processor will send out a short pulse from pin 35 of the CPP1 to fire the one-shot (IC2). It will then test pin 1 for it to time out. This is one dot time. For dashes, it will do this three times.

The tone is generated by IC3, a simple 500-Hz tone generator. Pin 36 of the CPP1 will go to a high level whenever the tone is on; it

S1 Open

S2A closed	S2B closed	S2C closed
E I S H 5 U F	T N D B 6 - K Y	? 2 V 3 4 A R
S2D closed	**S2E closed**	**S2F closed**
( ) C ; X / -- M G	L W P J 1 . "	Z 7 O Ø 9 8 : Q ,

[- hyphen; ? question mark; () parentheses; ; semicolon; / fraction bar; --break; . period; " quotation mark; : colon; , comma]

S2G closed

E?LTZ I2WN() SVPD7 JOT1A H3BCJ 654.X KUAIO YFR"M ,GVK9 A;JQ-- /80EL :-ZBI Z()7JX OM9--L ITNDC .1"KQ EBLWP B4ARV J0Z?2 V35UF G;8-E ISH6K Y,A/: XLCQP V2FEK :J--DK WR?U-6/79N "LAZ5 8HAM() T1B40 3;S,Z O1.EB JVGIY

S2H closed

Electronic Keyer Option

Practice Groups With Morse Code Pattern

S2A closed		S2B closed		S2C closed	
E	.	T	-	?	..--..
I	..	N	-.	2	..---
S	...	D	-..	V	...-
H	....	B	-...	3	...--
5	.....	6	-....	4	....-
U	..-	=	-...-	A	.-
F	..-.	K	-.-	R	.-.
		Y	-.--		
S2D closed		**S2E closed**		**S2F closed**	
( )	-.--.-	L	.-..	Z	--..
C	-.-.	W	.--	7	--...
;	-.-.-.	P	.--.	O	---
X	-..-	J	.---	Ø	-----
/	-..-.	1	.----	9	----.
--	-...-	.	.-.-.-	8	---..
M	--	"	.-..-.	:	---...
G	--.			Q	--.-
				,	--..--

Table 1.

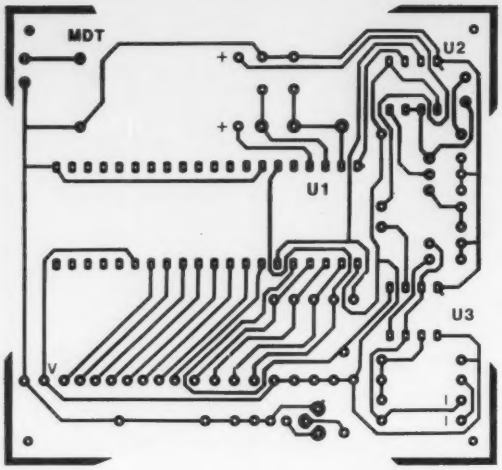

Fig. 3. Circuit board, foil side.

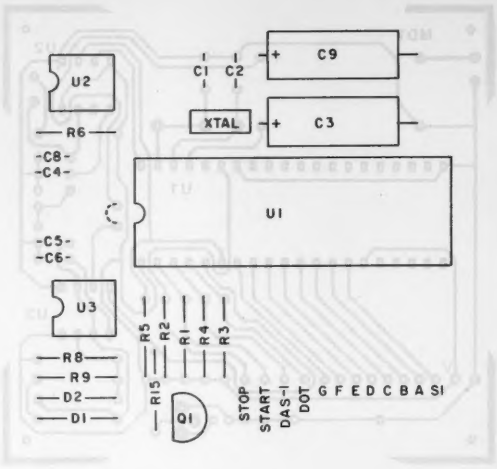

Fig. 4. Circuit board showing parts placement.

goes low to turn it off. To stop the sequence, pin 6 of the CPP1 must be pulled to ground through the stop button. (It should be noted that the start and stop buttons can be either normally-open push-buttons, as shown in Fig. 1, or toggle switches.) At this time, the processor will start testing the start pin again, except in the keyer mode.

In the keyer mode (switch S1 and S2 open), when the start is pressed, the chip will enter the keyer mode. To leave it, the power must be turned off. This is to eliminate any chance of the keyer going out during transmission.

S1 Closed

S2A closed								
HEFSU	5IEUH	H5EIF	USH5H	I5SFE	EI5S5	FEIHS	SUI5F	UEFHE
FUI5E	SIFHE	5UESH	HEFIU	FEH5I	USEFI			
S2B closed								
B-YTD	N6KBY	-KTD6	TYNKD	BKNT-	DY6D-	TBDKT	YKTND	-6KYK
BN-TB	KYTDN	6-KYD	D6YTK	YBTND	K6NYT			
S2C closed								
V4R2A	?3R42	A?VR3	24VA?	3A?V3	A23?3	24RAV	RRVV?	43?4A
V?A23	RAV42	3R2V4	AVR?2	V4R2V	?RV42			
S2D closed								
X;()GC	/--MXG	()XGCM	M/XM--	;C()--X	CGM--X	GXCM--	()MGX()	
;--X/C	X/()M;	MXCGM	--X;C/	GM/;C	CXM--G	M;/()X		
S2E closed								
J.L1P	"WPJ1	LW1."	L1JWP	.PJWL	P1"PL	1J.WW	LPJ1W	.WI1J
J"LWP	LJWP1	".JPL	1PWJL	LJ"P1	W.1JP			
S2F closed								
0:,ZO	798Q:	ZQO87	O9:,8	,OQ9Z	0:78Z	ZQ8,9	,8O:Q	:9Q9O
07ZO,	ZOQ9:	Q,9:Z	9OZ70	QZ0:9	8O7,Q			
S2G closed								
92837	46510	49628	53709	96821	13579	25680	95062	13467
53751								
S2H closed								
:.--"/	-:()?,	-:;.--	()"/,:	::--.?	?"()/:	.-:--,	:(),;.	
?"-.;/	()"/-?							

Table 2.

Construction

Assembly is very straightforward. The circuit can be hand-wired in about an hour or two, or a simple single-sided PC board can be used.

The crystal should be located as close as possible to the CPP1. This is standard for any microprocessor.

C7 must *not* be left out. This stabilizes the power to the chip when the tone is on. If it is left out, it is possible that the internal program will jump out of sequence.

Custom tailoring the CPP1 to your particular needs can also be done. Some examples are:

- replacing the speed control with a rotary switch with fixed resistors,
- replacing R9 with a potentiometer for tone control, and
- adding a volume control.

These are just a few of the many variations possible.

Operation

The CPP1 is extremely easy to use. Apply power. Set switch S1 to the appropriate practice table. Set switch S2 to the desired subgroup. Press start and adjust speed. That's it!

Your selected practice group will cycle until stop is pressed. At this time, another practice group can be selected. Speed may be adjusted any time.

To use the keyer function, set both switches S1 and S2 to the open position. Then press start. You are now in the keyer mode.

When pin 37 is brought to ground, a series of dots will be sent. When pin 38 is brought to ground, a series of dashes will be sent. Finally, when both pins 37

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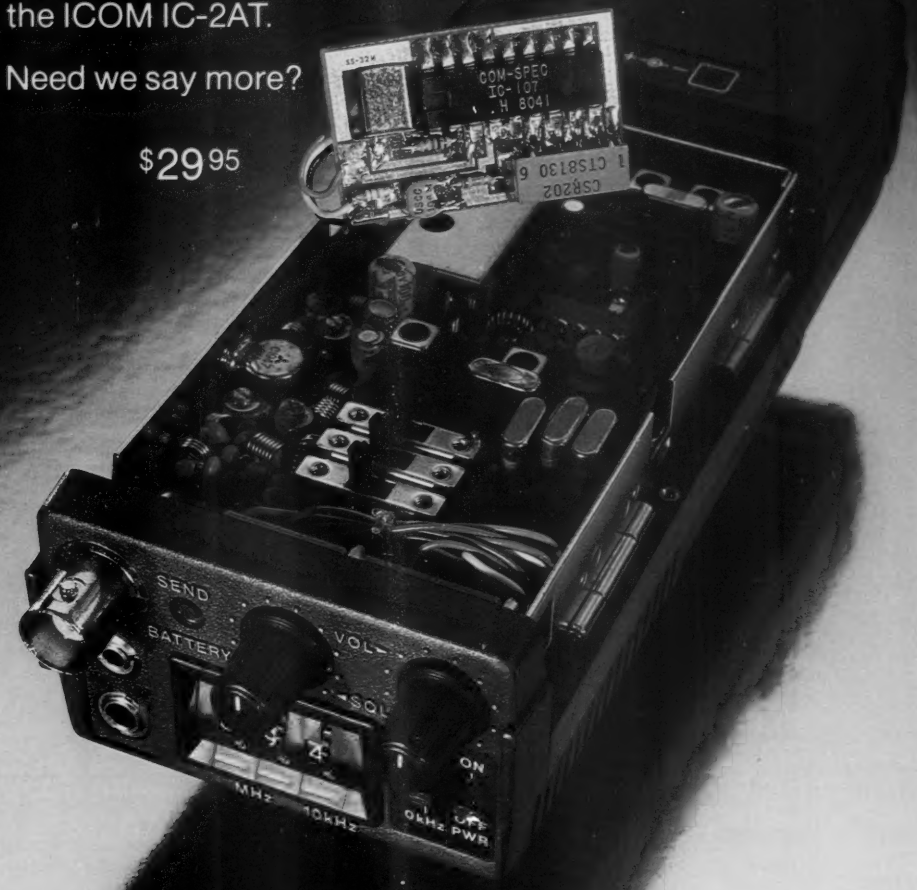

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Photo C. Adding a key turns the CPP1 into an iambic keyer.

and 38 are held to ground, alternating dots and dashes will be sent.

A final operating note concerning speed: Selecting the proper speed for practice may be done in one of two ways. The simplest way is counting dots. This is accomplished by setting the CPP1 to the keyer mode and pressing start. Hold the dot input line low and count the dots for one second. Once the number of dots per second has been determined, it is a simple case of calculating the speed by the following formula: speed (wpm) = 2.4 × dots/sec. For example, if 5 dots are counted in one second, then speed = 2.4 × 5 dots/sec = 12 wpm.

The second method is based on a known fixed resistor value. Since all timing is based on a dot time, it is a simple matter of using the following formula for determining the one-shot time: dot = 1.1 × (R6 + R7) × C8.

Conclusion

Learning Morse code, or increasing one's speed, has been a problem since the early days of ham radio. Learning Morse code should be fun and easy. However, traditional means using tapes and records generally make it less than desirable.

The CPP1 puts learning Morse code into the computer age without the hassle. Using the CPP1 makes learning code fun and easy. Using this device 15 or 20 minutes a day, followed by listening to actual ham conversations for about the same amount of time, will make code learning exciting and rewarding. ■

Parts List

QTY		
		ICs
1	IC1	CPP1 code practice processor
2	IC2, IC3	NE555 timer
		Capacitors
2	C1, C2	22 pF ceramic
1	C3	1 uF, 10 V dc
3	C4, C6	.01 uF
2	C5, C8	.1 uF
1	C9, C7	100 uF, 10 V dc
		Resistors
9	R1-R5, R8-R9	15k, ¼ Watt
1	R6	220k, ¼ Watt
1	R7	2 meg potentiometer
		Miscellaneous
2	D1, D2	1N914 or equivalent
1	S1	SPDT toggle switch
1	S2	8-position rotary switch
2	S3, S4	normally-open push-buttons
1	crystal	1-6 MHz (3.57 MHz nominal)
1	speaker	8-Ohm speaker
		Keyer Option
1	R12	4.7k, ¼ Watt
1	Q1	2N3904 or equivalent

The CPP1 code practice processor chip is available from Micro Digital Technology, PO Box 1139, Mesa AZ 85201, for $19.95 ppd., PCB, $5.00. Checks, Visa, and Mastercard accepted. On credit card orders, please include card number, expiration date, telephone number, and full name. For phone orders, call (602)-897-2534. OEM and dealer inquiries welcome. Complete parts kits available from the following distributors:

Greenbrier Marketing
International, Inc.
509 S. 48th St., Suite 105
Tempe AZ 85201.
Price: $49.95 postpaid.

Chaney Electronics
PO Box 27038
Denver CO 80227
(303)-781-5750

Circuit Specialists
PO Box 3047
Scottsdale AZ 85287
(800)-528-1417

Radiokit
Box 411
Greenville NH 03048
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Gigatech*
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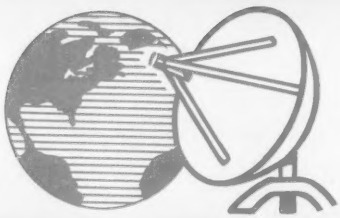

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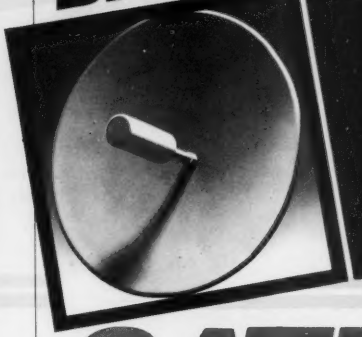

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The True Story Behind Heard Island

Fighting bad weather, shady ship owners, and bad press, the HIDXA expedition forged its way to the DXer's dream. But getting there was only half the battle.

The idea of a possible DXpedition to Heard Island came to Jim VK9NS while he was still P29JS and living in Papua New Guinea. Heard Island, in the southern Indian Ocean, is situated in one of the world's stormiest seas, uninhabited, inhospitable, and not really "en route" to anywhere. So the only way to get there would be to catch a lift or charter a vessel for the voyage. The vessel would have to be sturdy and suitable, with an experienced skipper for those waters. The cost for such a lengthy trip would be high, but if the money could be found, such a DXpedition could take place. So the Heard Island DX Association (HIDXA) was formed early in 1980, and the long and stormy road to Heard Island commenced.

Assistance was asked for, and many an amateur contributed. Jim, in his dealings with the authorities, met with goodwill and interest from all concerned. A set of guidelines was formulated for private expeditions visiting Heard Island, and he got permission to visit, pending a firm proposal. License for Heard Island was issued —VKØJS.

Meanwhile, the hunt for a suitable vessel was on, and word was out for interested operators. The season for visiting Heard Island is very short, involving January through March of each year. A vessel was in fact found for the 1981 season, but the enormous cost involved could not be met at the time, and this very suitable charter and experienced skipper had to be abandoned.

Unfortunately, HIDXA was now led astray by promises regarding a West Australian shipping firm who said that they intended to send a fishing-survey ship to Heard Island waters in the 1981 season and would take a group of amateur radio operators along for a reasonable sum of money. This proposal sounded just too good to be true, and of course, as we all know, it turned out to be just that.

Preparing for departure.

Equipment and stores in the hold of Cheynes II.

Jim and Tom VK6MK in Albany.

Months of not knowing and being put off with "we will know for sure next week" persisted until the season was over. During 1981, it was a continuation of "next week for sure," regarding plans for 1982, until it became clear that "next week" would never come. We heard that Dr. Lewis might be going to Heard Island on the *Dick Smith Explorer* in 1982 and we had berths booked on that ship should they be headed that way. As it turned out, they went to Antarctica instead.

So the hunt for a vessel for 1983 went on. The problem was mainly financial. People do not really want to give money to a project which is not 100% guaranteed. Money might be promised *after* the expedition, but shipowners want payment in advance. So we were really faced with a sort of "catch 22."

Now came the surprising news that IDXF and NCDXF had pledged $20,000 in order to send 2–3 operators along with a group of mountaineers who were planning an expedition to Heard Island to climb Big Ben. At the same time, concentrated efforts to discredit HIDXA and statements that Jim would never go to Heard Island and had no intention of even trying began to appear on the bands. Jim had always stated that if the expedition did not take place, he would refund donations. Four out of 300-odd persons who had donated to HIDXA asked for their money back; so it goes to show that most people do not take as gospel truth whatever they hear on the grapevine.

SoJo VKØSJ spent Easter of 1982 on Norfolk Island. He and Jim spent long days working on the Heard Island project. SoJo proved himself to be just what we needed most—someone with know-how, interest, and "get up and go." He went back to Tasmania and started looking for a vessel. Jim was reluctant to go on the air and say "we are going in 1983" until he was fairly certain that this time it would happen. So it was not until early September of 1982, when the contract with the owners of the ex-whale-chaser *Cheynes II* had been signed, that we could really start our publicity campaign. We sent out masses of brochures, "stuffers," and letters. Now that the vessel was secured, it was smooth sailing ahead. The beauty of this contract was that the vessel was big enough to take up to 20 passengers. So, if we could find even 10–12 people with other interests, and 6–8 operators, with all of us paying $3000 out of our own pockets, we could pay nearly the whole charter cost.

Universities were informed of this chance to visit Heard Island and advertisements were placed in several Australian newspapers. Gradually, the team started to take shape. A firm proposal to the government was drawn up. This was several pages long since it had to include details of all personnel, equipment, landing gear, supplies, etc. But once submitted, it did not take long for the official blessing to come through in writing.

Meanwhile, on the bands, word had it still that we would never go and were just daydreaming, that the ship was a floating coffin, it was no good, etc. Some of the DX outlets took the trouble to print some of the material we had sent along, but others must have filed it straight into the wastepaper basket since their publications were quite innocent of any mention of HIDXA. IDXF and NCDXF, on the other hand, were never out of the news!

There was talk of "the race to Heard Island" in those publications in which we did rate a mention. It was of course never a race. It was a matter of two groups, with different objectives, going more or less at the same time. We were just continuing what Jim had started in 1980. No doubt the mountaineering group had also been planning for some time, but without amateur-radio involvement, the world of ham radio would not know. Heard Island was high on the "wanted" list and you could probably put five successive groups on the island, all of whom would work tremendous pileups. For goodness sake, we work endless pileups from Norfolk Island where there are 6 licensed resident amateurs! So this "race" idea was a bit silly. One publication topped that by advising its readers to "put their money" on IDXF/NCDXF, as if we were horses. It passes all understanding, for sure.

We got a lot of support from individual amateurs in many countries, and we received a lot of encouraging letters with the donations, so we knew we had the support of the individual amateur. Some of the small DX clubs also contributed, but the big clubs did not come forward; an approach to NCDXF proved futile. The lack of publicity left many in doubt as to our intentions. When we received $100 from LIDXA, it was with a stern request to send the money back should the expedition not take place. We had already paid $6700 as a deposit on the *Cheynes II*, but they received our money-back guarantee in writing.

The cost of an expedition to such a place as Heard Island is immense. Apart from the remainder charter cost which was paid by the expeditioners themselves, HIDXA had to find money for fuel, landing gear, food, generators, tents, tarpaulins,

Do we go on or don't we? Chief Mate and Skipper make the decision.

Battling headwinds on the way to Heard Island.

gas cookers, gas, and a number of bits and pieces. A suitable first-aid kit and supply of pharmaceuticals had to be provided. Rigs and antennas were mostly on loan, but with a guarantee to return or replace them if lost, thus requiring expensive insurance in addition to the freight cost. It made me wonder about certain people's sanity when I heard inane remarks about "going on an expedition to get rich." The idea that a green stamp with a QSL card is clear profit and it costs nothing to mail a card back is fondly believed by some people.

Life became very busy from September through December. Jim left for Tasmania in November to be on the spot for all the last-minute arrangements that had to be made. I remained on Norfolk Island to handle incoming correspondence and hold the fort. We kept in touch via radio or telephone, but with everything else on our minds, we both forgot our wedding anniversary on December 5; 2 years —you would think we had been married for 20.

I arrived in Tasmania on December 29. Those last few days before departure were very hectic. What with the holiday season and all the festivities, it seemed impossible to organize the final details, and departure had to be postponed for a couple of days. The rest of the team had already arrived. We were 17 people, including 5 scientists, 5 mountaineers, a journalist, and a cinecameraman. A mixed group for sure, but as it turned out, a very balanced group. We all got on well with each other. Maybe the fact that each and every one of the expeditioners was required to pay $3000 ensured that no one who was not very strongly motivated and did not really want to go to Heard Island was included in the expedition. We could have filled the ship with people who wanted to come for nothing, but our policy did not permit any freeloaders who might cause arguments and backbiting if the going got rough. A very wise move as it turned out.

Our troubles should now have been over, but this was not to be. We departed Hobart January 4 and struck a strong gale immediately. After battling ahead for 24 hours, the skipper advised that due to the high rate of fuel consumption and slow progress, we should return to Hobart to await more reasonable weather. Turning around in those mountainous seas was a frightening experience. The *Cheynes II*, which had been tossing around violently for hours already, now laid over momentarily to a 40° angle which sent everything crashing and broke the lashings on the two dinghies stowed on the foredeck. During the night, a wave had shot up under the boat deck and knocked a 3" plank clean out, so it was a slightly battered *Cheynes II* that returned to Hobart the following morning.

We now had three days of hanging around Hobart, impatiently waiting for the weather to improve. It did improve somewhat, but we still stayed with no explanation forthcoming. Finally, we were scheduled to leave on Sunday morning, but Saturday evening we learned that departure had been postponed once again since the skipper/owner had decided not to come with us. A new skipper was found, and on Sunday afternoon, Captain Laurin MacEwan arrived and we were off again.

The southern route was abandoned. We took a westerly course while the skipper made himself familiar with the vessel. He soon found that the fuel consumption was alarmingly high. It bore no relationship to facts and figures quoted on our dealings with the company. In fact, Captain MacEwan found that we could not go to Heard Island from Hobart. The ship just did not have the range, in spite of all the expert advice and calculations which had been done by professionals. The only thing to do now was either to cancel the expedition or go to Albany, in western Australia, to refuel and make Heard Island from there. Naturally, we all agreed it would have to be Albany. There was no question of the ship not having the range for that distance. The mystery of the fuel consumption followed us all the way. Tanks were dipped

Peter VK6VR, Walter OE1LO, Kirsti VK9NL, SoJo VKØSJ, Bernie VK6KJ, and Walt W7SE at Albany.

Our home on Heard Island.

VKØJS shack.

and charts consulted. Nothing seemed to add up. It was a worry for several days before they thought they had the problem licked.

We continued our voyage after refueling in Albany, and for some days everything ran smoothly. We settled down to a routine for shipboard life. All expeditioners were rostered for duty in the galley or on the bridge. Three would do the cooking, with cooks changing each day, and normal 4-hour watches were kept on the bridge, around the clock. The expeditioners got to know each other and the crew of 8, and with so many people with different backgrounds and experiences, there was always a lot to talk about.

Unfortunately, one of the operators, Walt W7SE, found it necessary to withdraw from the expedition in Albany. By then we were already so much delayed that he just could not risk further delays which would make him late back for work. Another scientist joined us in Albany so the number of people remained the same.

It now became apparent that we did not have enough water on board for the boilers. This was another mystery, but nevertheless a fact. We were supposed to carry 170 tons of water, but in fact, had only about 80 tons, another reason why the vessel did not have the range. The only thing to do now was to call in at Kerguelen Islands to take on water. This would cost us extra fuel which we could ill afford. Arrangements were made with the owner that he would meet us on the way back with the necessary fuel to take us back to port in Australia.

Thus, we made a stop at Kerguelen. The French were kind and helpful. It seemed to us that we had been at sea for a lifetime, when in fact, it had been just two weeks since Albany. We had a lot to learn yet! The French invited us all ashore for lunch, and we savored every morsel of that meal. There was of course no chance of operating from Kerguelen. It was an unplanned-for port of call, and the necessary license could only have been issued in Paris, well in advance. In any case, we stayed only a few hours, so time would not have permitted operating from there.

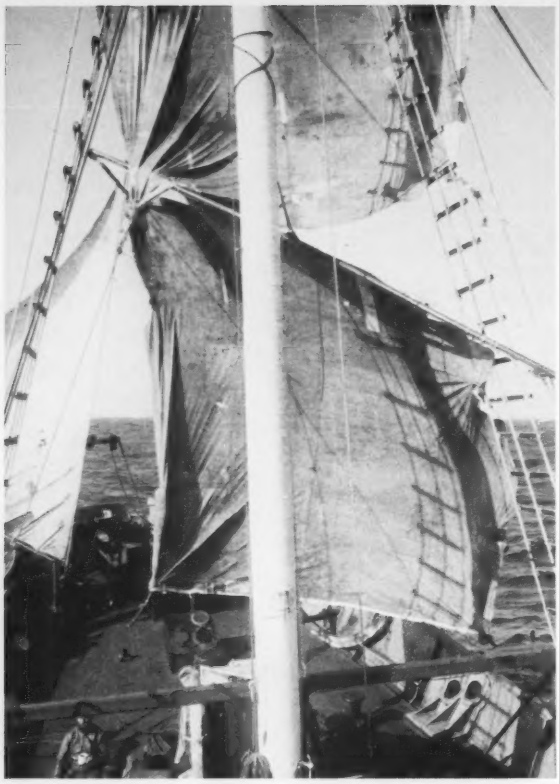
Once again the expedition nearly came to a full stop. The *Cheynes II* dragged anchor and we could hardly believe our eyes when we dismally observed her drifting onto the rocks. It was very fortunate that nothing vital was damaged and we were able to continue on to Heard Island.

Finally, on February 5, there it was: Heard Island. We arrived in rain and mist, but it was reasonably calm, so unloading commenced right away. Plans for landing equipment and personnel had been made during the voyage. All gear and food had been wrapped securely in plastic and sealed, so offloading went smoothly. We had had breakfast at 4:30 am in order to make an early start.

Now began a back-breaking day. We had two Arbec huts for our use. The scientists and film crew settled into the one closest to the beach, and the hams had the other, smaller one up the hill. These huts are mere shells of unlined metal. They are completely devoid of furniture or amenities. But, they were waterproof even if somewhat drafty. Our hut was about 500 meters away and every bit of equipment, antennas, food, gas, cookers, generators, etc., had to be hand-carried all the way from the beach. The trips to and fro were many, and I think we had all reached the stumbling stage by the end of the day. It rained; the black volcanic sand stuck to everything and the path was rocky and uneven. Finally, the beach was empty and we could think about getting a rig on the air and see about sleeping space and something to eat.

It was dusk by now. Our hut did not have a door. In spite of the rain which now came in torrents, the icy wind in the doorway, and the cramped conditions inside the hut, we got ourselves into some sort of order. Bob got one of the generators going and with a vertical antenna he was ready to open up from VKØJS. His first QSO went to ZS6IW. He worked some Europeans, but with the rain pouring down onto the unprotected generator, there suddenly was a power surge

The day the sun came out; Big Ben.



Tarpaulins made makeshift sails for the Cheynes II.

which put a stop to operations. We all retired to our sleeping bags. Being utterly exhausted, we slept extremely well.

I was the first one awake the next morning. Jim, SoJo, and Bob looked like three blue elephant seals in their sleeping bags. It had stopped raining, and soon we were all busy putting up more antennas, making the hut more livable, and getting properly organized. A 3-element ten-meter beam and a 3-element 15-meter beam were unpacked and erected without any trouble. We had brought a Minooka Special for 160 meters, but unfortunately, even with all expeditioners lending a hand, putting up this huge vertical proved too much in the strong wind. She bent beyond repair and had to be abandoned. The TH3 tribander was the last one to go up, complete with rotor. The other beams had a hand-operated turning arrangement. One of the tents was put up to house the generators, and inside the hut, Jim hung other tents to keep some of the draft out, the final one being hung in the doorway to act as a door. We had four rigs ready for use and had brought spare rigs just in case.

A solar flare made radio conditions extremely poor. I suppose we were lucky it did not put a full stop to propagation for the duration of our stay, but it was very unfortunate that it had to happen at all. We worked. One of us would monitor the bands and call CQ regularly. If there was an opening, we knew about it and made the most of it. Openings sometimes lasted only a few minutes, but after a few days, we found that 20 meters was usually open to America in the early morning hours. Europe was around in the evenings, and Asia and Pacific at odd times during the day. Nighttime was a bit unpredictable, but we kept watch on the bands around the clock.

We were now joined by Walter OE1LO, who had been helping the mountaineers get started on their climb up Big Ben on a new route from Mechanics Bay. With the poor band conditions, we were more than enough operators, and some of us actually just sat idle most of the day. SoJo was in charge of all RTTY and SSTV gear and made the first QSO ever from Heard Island on these two modes. He also made the first satellite QSO from Heard Island. So, by making use of every little opening, the number of QSOs crept up. VKØJS made about 12,400 QSOs, with VKØNL making about 2000. This was not a bad score in poor conditions.

The *Anaconda II* operators were also active. This meant that only one of our stations could operate on whatever band happened to be open. If VKØCW was on 20 meters CW, then we could only be on 20 meters SSB instead of having one station on CW and one on SSB. This, of course, applied to the other group as well.

Bob took charge of the generators. He kept them going, serviced them, refueled, and did some repairs. None of us got a tremendous lot of sleep. The shack was noisy, cold, and cramped. But the days passed quickly. We were more or less self-contained in our hut, being able to do the basic cooking there and not having to leave the bands to turn up for meals in the other hut. Not very sociable, but time did not allow for socializing. In fact, when the other three ladies of the expedition were invited aboard the *Anaconda II* for dinner one evening, I was not even asked. At least I like to think that this was because everyone knew the hams were too busy to socialize! (It could have been those shapeless oilskins combined with my advanced years, of course.)

So we worked. The scientists took samples from penguins, counted them, measured temperatures on rocks and under rocks, collected samples of this and that, and generally had a very successful time on the island. The mountaineers climbed their new route towards the summit of Big Ben, keeping in touch by VHF skeds twice daily. The film crew filmed everyone and everything and will have an excellent documentary of the whole fantastic voyage and stay on the island, to be released on Australian TV in June/July, 1983. It is expected that this film will also be released overseas in due course.

We had hoped to extend our stay a few more days, but due to the precarious fuel situation on the *Cheynes II*, this could not be. So we were due to depart February 15 at 1600. In preparation for this, we started to carry some things to the beach, intending to keep one rig on the air till the bitter end. However, the wind was quite strong, and by lunchtime, a full storm blew up. This was the Heard Island we had feared. Atlas Cove boiled; sea spray was blown far inland. Ashore, the black volcanic sand whipped and blasted. The *Anaconda II* operators lost their beam; the mast just buckled effortlessly. It became clear that departure was impossible and we made our way down to the beach to make sure the gear already there was secure. Here, we found that the seas were rising and everything had to be moved further up—an enormous task in that wind. Gusts were measured up to 80 knots and some of us were literally blown off our feet. At one stage, I was sent flying and ended up underneath the tarpaulin which we used to cover the goods. The *Cheynes II* had to get up steam to keep from drifting

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In oilskins and mittens, doing the dogwatch while under sail.

onto the rocks, and the skipper told me later that he had never before seen the wind actually blowing big holes in the sea the way it did that day.

Things could have been worse. The storm could have lasted until the *Cheynes II* was out of fuel for that matter. As it was, she burned up a considerable amount that day and the next, but the wind did abate and we were finally able to get on board on the 16th at lunchtime.

It was a hurried, cold, and blustery departure. The island looked extra miserable with sleet and snow settling on the black hills. The ride out to the ship was bumpy and frightening for those who cared. I did not; I was exhausted and retired to my bunk and refused to come out for the remainder of the day!

Heard Island is a unique island, black and white with a bit of moss covering some of the rocks. There are no insects to speak of, just a wingless fly and a wingless moth. Seals and penguins are the permanent residents, and there are many birds. We found time to go for short walks and see the sights. One day when the weather was very mild with sun breaking through, the island looked beautiful in its own stark way. But the climate is miserable. As I had it explained to me: It is not that it gets so cold, it is just that it does not get warm enough for things to grow. There is very little sun—mostly rain and mist. With a summer temperature around +5° C, only 8 vascular plants and some mosses and lichen represent the growth of millions of years.

I would not mind going back some day, but on a guaranteed vessel—guaranteed not to run out of fuel and to be unsinkable. The *Cheynes II* is probably very close to unsinkable. She proved that she could perform some amazing feats—standing up on her hind legs and laying over on her side, all in one quick motion. But. . .there was the fuel/water problem. I was dimly aware of talk of sails and so forth but had been too busy to think about it. Now it had to be faced. After two days steaming, the engines were shut down and sails were hoisted on the foremast. The "sails" were actually our tarpaulins which were made fast to yardarms welded together on board from bits and pieces. With no engine, we had no electricity, so the emergency steering gear on the open afterdeck came into use. The wheel itself was enormous; it took two people to turn it before the grease worked its way through. A compass was laid to rest on a lifebelt inside a drawer which was tied in front of the wheel. A small wind sock above indicated how the wind was in relation to the sails (which we could not see), and appropriate chalk marks on the tiller flat showed how much helm we had. Thus, 400 tons and 160 feet of iron steamship became a square-rigged sailing vessel!

We were still far south since this was where the prevailing wind and current could be used to our advantage. Sometimes the speed was less than 1.5 knots, but at other times, we reached a stunning 4.5 knots. The albatrosses settled down to paddling in our wake, and we kept studying the foam alongside to try to guess if we were moving or not. It was very uncomfortable, cold, and dark, with watchkeeping done on the afterdeck more frequently now since two of us had to be on duty each period.

Incredibly, we inched our way ahead. I think the worst of it all was the bitter, cold wind and the dark. The diesel generator would run for 3–4 hours each evening to charge the batteries on the bridge. This was the highlight of the day when I would rush to our cabin and switch on the bed lamp in the hope that the warmth from the globe would perhaps yield a bit of warmth to the pillow before bedtime.

After 13 days of this, the boilers were fired up and the engine restarted, since we expected to meet the owner with the promised fuel and water in a couple of days time. However, after two days steaming, we learned that the refueling ship had been delayed. This was a great disappointment. Another 3 days of sailing, and at last, after 855 nautical miles under sail, we made the rendezvous. Another pie in the sky; there was no refueling—we were to be towed home. A 1000-foot line was attached, and we continued our cold and dark existence for yet another 7 days although we did not have to stand watch on the open deck.

For reasons best known to himself, the owner now instructed the skipper to forbid amateur radio on *Cheynes II*. He "did not want any talk about what was going on" was the comment we heard. No other reason was given. I am not sure exactly what it was he did not want us to talk about, but it seemed pretty silly, since anyone could make a Radcom call and talk his mouth off to anyone. And the news media were interested. They even hired a plane to come out and see for themselves, a couple of hundred miles off the coast.

We had started to run out of some foods. The variation in meals was not great in the end, but we were not in any immediate danger of starving. It was a matter of look-

The Saxon Onward *takes us in tow.*

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ing at the bright side. For instance, without butter, margarine, or cooking oil, washing up in seawater became mere child's play since we had no greasy dishes. And with not much to cook, the cooking chore became fairly simple. As the trip was supposed to have lasted a maximum of 42 days, and we had eaten well for 72 days, I would say that in this important area at least calculations had been liberal. Even when we finally berthed in Albany, West Australia, there were baked beans, tinned tomatoes, and packet soup left over. We could in fact have spent a few more days at sea but were certainly happy not to be obliged to do so.

During all our trials the group stayed together. The mood in the mess room remained lighthearted and cheerful, and no one allowed him/herself to show any short-tempered ill feelings which so easily could have jeopardized the easy-going comradeship which reigned. In any case, any short temper would have been caused by minor irritations and would not have been worth showing off. We were literally "all in the same boat" and knew it.

Nearly home and relaxing in the sun: Jim VK9NS, Kirsti VK9NL, Walter OE1LO, SoJo VKØSJ, and Bob WA8MOA.

The whole expedition had been an uphill battle with problems arising one after another for months before we even left Hobart. To top it off, we found that evil tongues had been wagging on the amateur bands while we were battling our way home. "They have lost the logs" was the cry. Was there no end to it all? Jim took the unprecedented step of having the logs sighted by Tom VK6MK, in Albany, as proof that we had not lost them. Tom subsequently advised WIA that the logs were intact. How can anyone stoop so low as to start such rumors? Especially someone sitting snug and comfortable in his safe home thousands of miles away from Heard Island or *Cheynes II*? How do they explain their "knowledge"? The only explanation I can think of is that someone is determined to discredit HIDXA at any cost—even at the cost of their own honor and credibility. Why? What are they afraid of? Is amateur radio a hobby or has it become big business?

The Heard Island and *Cheynes II* experience was no picnic. We did it because we wanted to activate Heard Island and had said we would do so. And as my granny used to say: "What does not kill you will make you stronger!" ■

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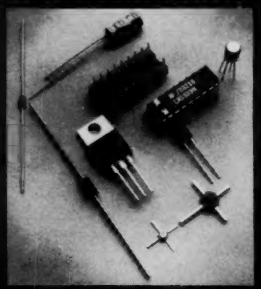

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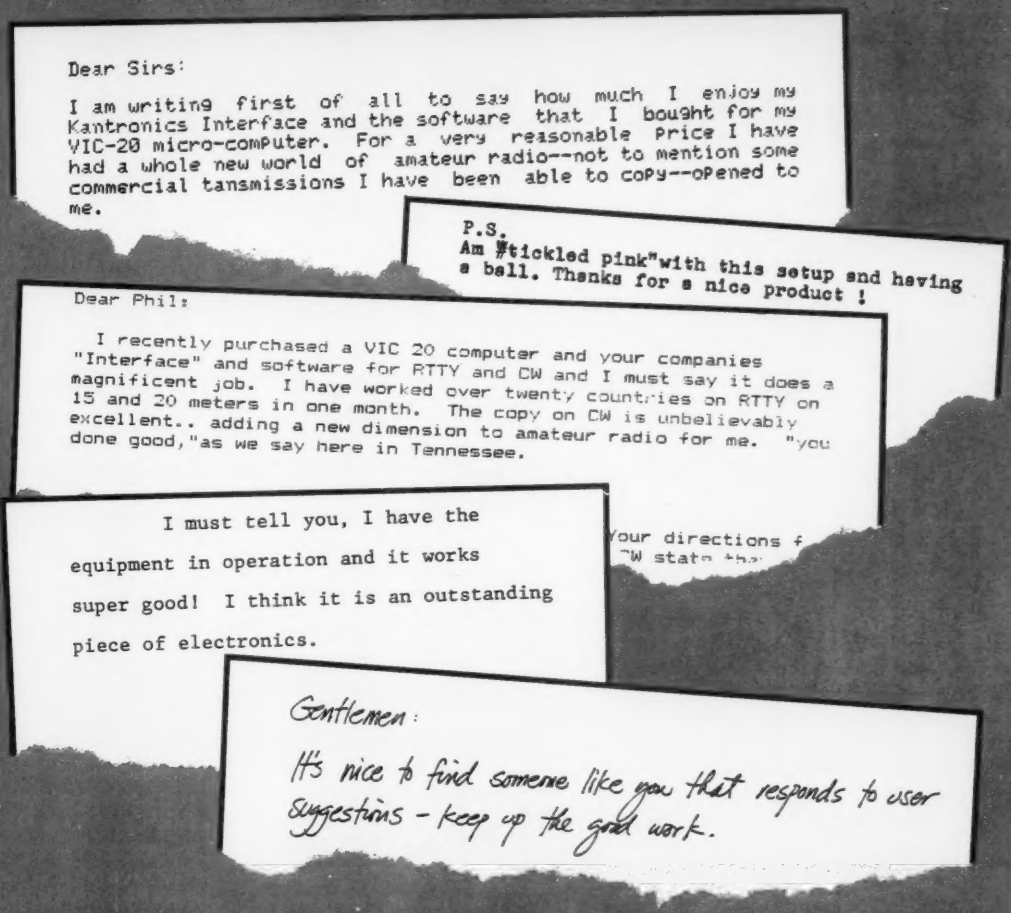

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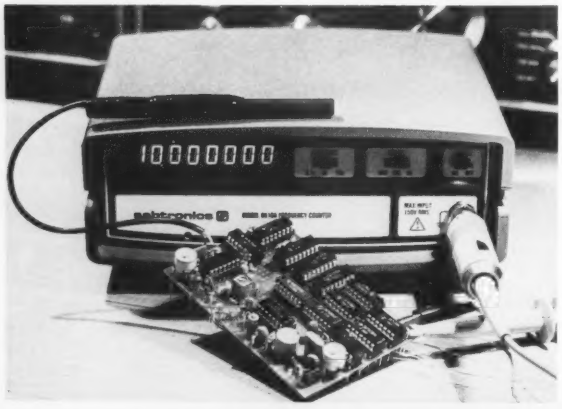
Have you ever followed the conversation of two guys on the same frequency using identical several-thousand-dollar transceivers but reading off different frequencies from their digital displays? Or did you ever wonder how to estimate the drift of your own frequency counter when making frequency-drift measurements on your new rig or project just finished?

Of course, there are various means to overcome these problems. Temperature-controlled ovens as an option for your frequency counter, for example, are readily available. They will give the crystal in your frequency counter a short-term frequency stability on the order of 0.1 ppm. However, they lead to an increasing uncertainty about the actual accuracy due to the aging process in the crystal—and they cost 50 dollars or more.

On the other hand, precise frequency reference signals are delivered more or less free of charge to our shacks by the National Bureau of Standards or by means of TV signals synchronized with a cesium standard.

It is not to everyone's taste, however, to deal with fading signals from a distant standard-frequency transmitter or to hook up a TV set to a frequency counter. So there must be another way to take advantage of precise reference signals generated elsewhere but which are already easily available in the ham shack.



The circuit in actual operation, with the ferrite antenna on top of the counter. Output frequency is 10 MHz, phase-locked to a selectable AM-broadcast station.

The Basic Idea

In almost every populated area of the country, at least one AM-broadcast station in the 450-1800-kHz band is available which is strong enough to be heard even in the basement of a building or in the concrete jungle of city centers. All the care necessary to maintain a stable transmitting frequency has been taken at the radio station already, so there is no need to start all over again.

Usually, the radio stations maintain a stable frequency

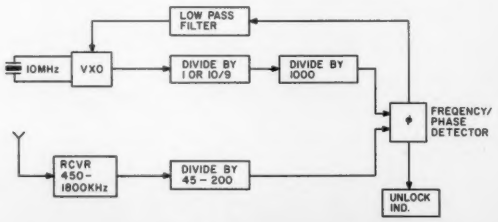


Fig. 1. Basic concept.

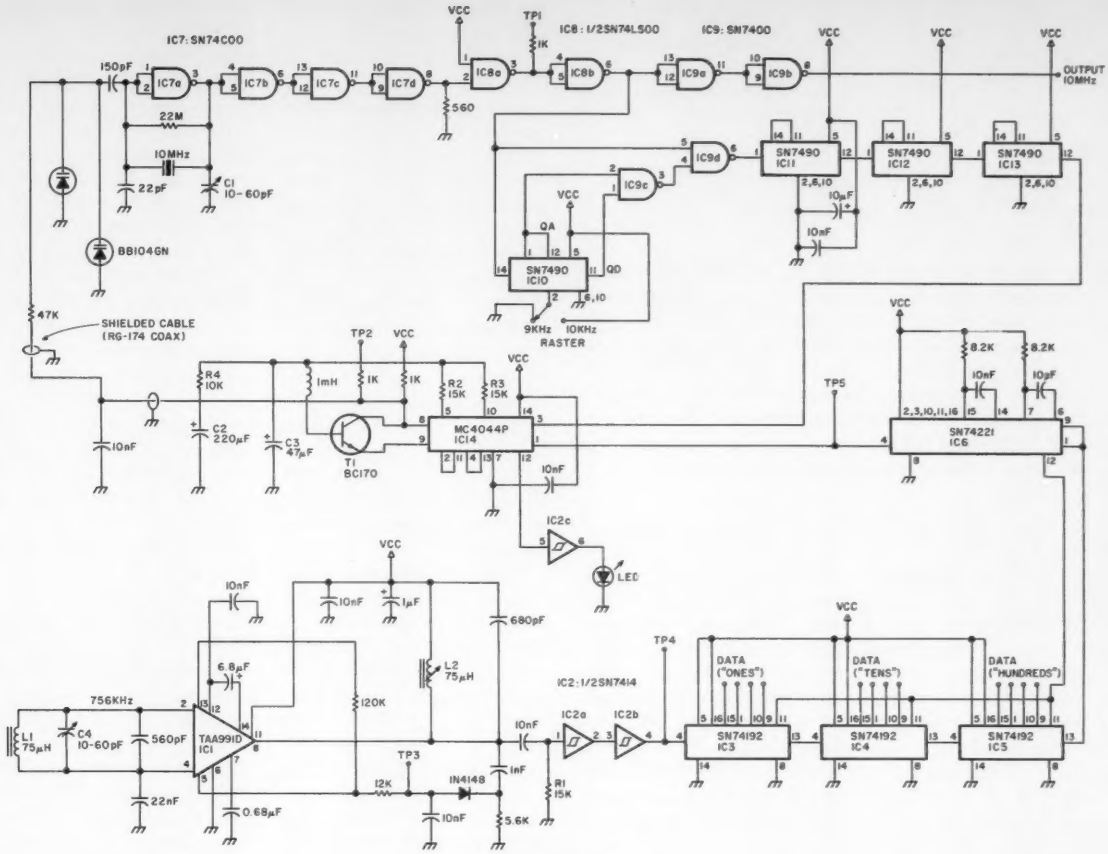


Fig. 2. Schematic diagram.

by means of a crystal oscillator whose frequency is regularly checked against and aligned with a reference frequency from the National Bureau of Standards or a secondary source of a reference frequency of similar accuracy. Even better, the ultimate step has already been taken by phase-locking the radio transmitter frequency to a reference frequency of the National Bureau of Standards.

The transmitting frequency of the Deutschlandfunk (DLF), phase-locked to a frequency standard generated by the PTB, the German National Bureau of Standards (Physikalisch-Technische Bundesanstalt), is one example. The PTB transmission on 77.5 kHz has a frequency stability of better than 10^{-6} ppm per day (10^{-12}).

Due to variations of propagation, the frequency of the signal received 300 km away from the transmitter still is accurate to better than 0.01 ppm (10^{-8}) or 0.001 ppm (10^{-9}) for measuring periods of 1 and 10 seconds, respectively.[1] But while a short-term stability of station DLF on the order of 0.0001 ppm (10^{-10}) is achieved by a well-regulated crystal oscillator, the small variations of the received reference frequency are filtered out by a very slow response of the frequency-control circuit resulting in a long-term stability in the same order of the broadcast-transmission frequency.

Most frequency counters and secondary frequency standards use a 10-MHz crystal oscillator as a master clock from which other time signals or frequencies are derived. And many frequency counters and signal generators already have a provision for synchronization or triggering by an external frequency standard.

My basic idea, therefore, was to build a 10-MHz crystal oscillator, phase-lock it to an AM-broadcast transmitter of high frequency stability, and use it as a virtually drift-free frequency/time signal generator of high accuracy for frequency counters, calibrations, etc. Some of the design specifications were:

- The unit should be programmable to accommodate the AM-broadcast frequencies of interest.
- It should be small enough to fit into existing equipment without employing large external antennas, thus maintaining portability of the equipment.
- It should generate a 10-MHz TTL signal with an accuracy similar to the accuracy of the AM-broadcast transmitter employed, i.e., with a short-term stability of at least 0.01 ppm (ten times better than an oven-stabilized crystal oscillator) and an even higher long-term stability.
- It should be programmable for the 10-kHz raster of AM-broadcast transmission frequencies employed in the US and for the 9-kHz raster already in existence in Europe.

The basic concept is shown in Fig. 1. A simple receiver picks up a signal of an AM-broadcast transmitter in the 450-1800-kHz range. The carrier frequency is isolated from the modulation and fed to a frequency divider with a programmable division ratio of 1:45 to 1:200.

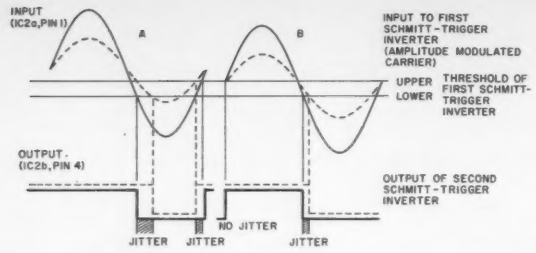


Fig. 3. Operation of the two Schmitt-trigger inverters. (a) Without a pull-down resistor, the input signal resides on the high input level of the first Schmitt trigger. Both edges of the output pulse of the second Schmitt trigger are jittering due to the amplitude modulation of the input signal. (b) The high input level of the first Schmitt trigger is pulled down by a resistor. Triggering occurs at the zero-crossing point of the rising edge of the input signal resulting in a jitter-free rising edge of the output pulse of the second Schmitt trigger.

For the 10-kHz raster of AM-broadcast frequencies employed in the US, a range of division ratios from 45 to 180 is selected to yield a 10-kHz signal at the output of the divider. For example, for station WJR in Detroit on 750 kHz, the division ratio would be set to 75, and so on. For the European raster, a range of division ratios from 50 to 200 is selected to yield a 9-kHz output signal. A ratio of 84, for example, divides the carrier frequency of station DLF on 756 kHz to 9 kHz. The 10- or 9-kHz output signal is fed to a frequency/phase detector as the reference frequency.

The desired 10-MHz signal is generated by a variable crystal oscillator (vxo) whose output signal is frequency-divided in a pre-divider by 1 (US) or by 1.111 · · · (Europe) and then divided again, by the main divider chain, by 1000 to yield an output signal with a frequency of 10 kHz (US) or 9 kHz (Europe). This variable frequency is fed to the frequency/phase detector, too, which produces a corresponding error signal if variable frequency and reference frequency do not coincide regarding frequency and/or phase.

The error signal is passed through a low-pass filter in order to remove the 10-kHz (9-kHz) components. The dc component of the error signal is applied to a varactor diode in the vxo to pull its frequency up or down as required. This dynamic process comes to a rest when both frequency and phase of the variable frequency from the vxo and the (constant) reference frequency coincide on the 10(9)-kHz level, which in turn produces a steady control voltage for the varactor diode in the vxo.

Any tendency to leave this steady state due, for example, to a change of ambient temperature and its impact on the vxo frequency is immediately balanced by an appropriate change of the amplitude of the error signal, thereby keeping the vxo on phase and frequency with respect to the reference frequency (phase-locked loop). An "unlock" indicator signals if phase-lock has not been achieved.

The Circuit

The complete schematic diagram of the circuit is presented in Fig. 2. The simple AM-broadcast receiver consists of the integrated circuit (IC1) designed for the front end of AM/FM receivers. Various types of applicable ICs are on the market. The TAA991D chosen here operates from a 4.5-11-volt supply; it has a voltage gain of 90 dB and an agc range of 60 dB.[2] The TAA991D amplifies the signal of the AM-broadcast station received by the ferrite antenna, L1, to about 4 V_{SS} at its output.

The very efficient gain control accommodates a wide range of input-signal amplitudes and can cope even with very strong signals of nearby broadcast stations. Furthermore, the time constant of the gain control is kept so short that it also compensates carrier-amplitude variations due to the modulation. Measurements showed that an amplitude modulation of the carrier frequency of more than 90% is reduced to less than 5% by the circuit, resulting in an almost steady carrier signal at its output.

Most AM stations modulate far less than 90%, however. The output signal of the gain-controlled amplifier is ac-coupled to a Schmitt-trigger inverter, IC2, which is pulled down at its input by resistor R1 to a level of about 1.3 volts.[3] The value of R1 should be adjusted so that the rising edge of the sinusoidal carrier signal triggers the Schmitt trigger at or near its zero-crossing point (see Fig. 3). Thereby, the modulation of the carrier is removed almost completely, resulting in a jitter-free falling edge of the Schmitt-trigger output signal. At the output of the second Schmitt trigger, IC2B, a jitter-free rising edge is obtained which triggers the programmable divider which follows.

The programmable divider is a chain of three binary-coded decimal (BCD) up/down counters, IC3-IC5.[3] Generally, the incoming carrier frequency can be divided by any integral number from 001 to 999. However, as mentioned earlier, only the range from 045 to 200 is needed. The "ones" of this number are represented by the first counter (IC3), the "tens" by the second counter (IC4), and the "hundreds" by the third counter (IC5). Pins 15, 1, 10, and 9 of each counter accept the respective digit number in BCD form. If these pins are in logic state 1 (i.e., connected to V_{CC}), their contribution to the digit number is 1, 2, 4, and 8 respectively. If they are in logic state 0, they do not contribute at all.

For example, if the carrier frequency of station WJR on 750 kHz is to be divided down to 10 kHz, the number to be programmed is 075. In this case, the logic states of pins 15, 1, 10, and 9 are 0, 0, 0, 0 for IC5, 1, 1, 1, 0 for IC4, and 1, 0, 1, 0 for IC3, in that order ($0\times1+0\times2+0\times4+0\times8=0$, $1\times1+1\times2+1\times4+0\times8=7$, and $1\times1+0\times2+1\times4+0\times8=5$ all together corresponding to 075). As the three counters are wired as down-counters, the number 075 loaded this way is reduced by 1 for each cycle of the incoming carrier signal.

If number 000 has been reached, an output pulse at the output of the counter chain (pin 13 of IC5) is generated which is used to reset the counters to the state programmed initially (075 in the example). The very short output pulse is stretched to approximately 50 nanoseconds by one of the monostable multivibrators of IC6 and applied to reset pin 11 of each counter.[3]

Because only one output pulse is generated for 75 input pulses, a division of the carrier frequency by 75 is achieved. The other monostable multivibrator of IC6 which follows stretches the length of the 10-kHz output pulse to about 50 μs for further processing. For the European raster of AM-broadcast stations, the same considerations apply. The carrier frequencies are multiples of 9, however, and a reference frequency of 9 kHz is obtained by division of the carrier frequencies by integral numbers from 50 to 200 in order to utilize AM stations in the range from 450 to 1800 kHz for the same purpose.

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The vxo consists of a low-cost microprocessor crystal and one CMOS gate (IC7, same pinout as IC8[3]) as the active device. The double-varactor diode, BB104 green, has a capacity swing from 35 pF at 3 volts to 14 pF at 30 volts of reverse bias. Any other varactor diode of similar characteristics is applicable. For a voltage swing from 1.5 to 5.0 volts at TP2, a frequency deviation of approximately +60/−95 Hz from the nominal frequency of 10 MHz was measured. Initially, trimmer capacitor C1 is adjusted so that an error voltage of about 3 volts is measured at TP2 for a vxo output frequency of 10,000,000.0 MHz.

Several inexpensive crystals were tried out with appropriate readjustment of C1, and they gave similar good results. The CMOS level of the vxo signal is converted to TTL level by the combination of one low-power Schottky gate (IC8A) and a 560-Ohm pull-down resistor at its input.[3] Another gate (IC8B) is used for buffering the 10-MHz signal. It is further buffered by TTL gates IC9A and IC9B and passed to the 10-MHz output terminal.

As the 10-MHz signal is going to be checked against a reference frequency of 10 (US) or 9 (Europe) kHz, it must first be divided by 1 or 1.111 · · · giving a frequency of 10 or 9 MHz. The chain of three decade counters (IC11-IC13[3]) which follows divides that frequency down to 10 or 9 kHz and this signal is passed to the frequency/phase detector as the variable frequency together with the 10- or 9-kHz reference frequency from the AM-broadcast receiving branch of the circuit.

The alternative division by 1 or 1.111 · · ·, respectively, is achieved by the combination of decade counter IC10 and gates IC9C and IC9D.[3] If pin 2 of the decade counter is high, i.e., at V_{CC} level, the counter is disabled

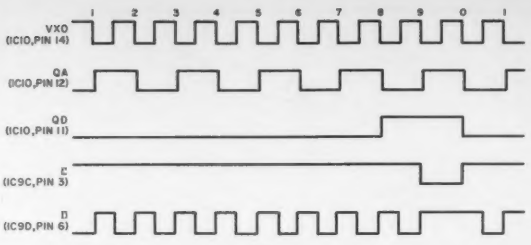

Fig. 4. Operation of the divide-by-1.111 · · · module as explained in the text.

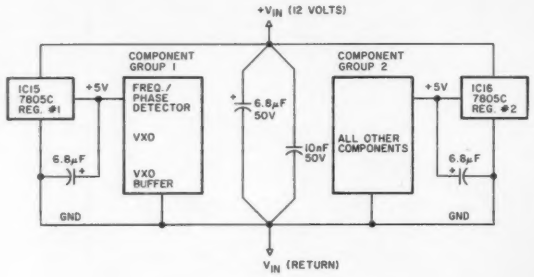

Fig. 5. Power supply.

and its output terminal (pin 11) is in a low state. Consequently, the output of gate IC9C remains high constantly, enabling gate IC9D which passes the pulses from the output of gate IC8B directly to the input of the chain of decade counters. No frequency division takes place in this case (division by 1). However, when pin 2 of the decade counter is in a low state (grounded), the counter is operative. Its action is explained in Fig. 4.

The counter contains a chain of four flip-flops with designations Q_A for the output of the first and Q_D for the output of the last flip-flop. For the arrangement shown in the schematic, the first flip-flop is triggered by each negative transition of the vxo pulse sequence. Q_D assumes a high state after 8 input pulses and is reset to a low state after 10 pulses. This constitutes one complete cycle of the decade counter. The logic combination of outputs Q_A and Q_D by gate IC9C produces signal C at its output. And the logic combination of signal C and the signal of the vxo by gate IC9D generates a sequence of pulses (D) similar to the signal of the vxo with the exception that for every 10 pulses of the vxo one pulse is missing. Therefore, 9 pulses are generated at the output of gate IC9D for 10 pulses of the vxo, constituting a division by 10/9 = 1.111 · · ·.

The frequency/phase detector, IC14,[4] checks the frequency/phase difference between the reference frequency and the variable frequency, i.e., the AM-station carrier frequency and the vxo frequency, respectively, both divided down to 10 (US) or 9 (Europe) kHz. 10(9)-kHz pulses appear on pins 5 and/or 10 with a duty cycle corresponding to the difference. These pulses are filtered by a low-pass filter (R2, R3, R4, C2, C3, 1-mH choke) and buffered by transistor T1.

Any small signal transistor is applicable here provided it has a gain high enough to meet the following specifications: no frequency/phase difference generates a voltage of about 3 volts at TP2; a higher frequency or a leading phase of the variable frequency (vxo) with respect to the reference frequency generates voltages of down to 1.5 volts or up to 5 volts in the contrary case.

This error voltage is applied to the varactor diode of the vxo which pulls the crystal frequency to achieve zero frequency difference and a very small but constant phase difference. At pin 12 of IC14, negative-going pulses are generated whose duration is proportional to the phase difference of variable and reference frequency. They trigger the Schmitt-trigger inverter, IC2C, which turns on an LED in case of a wide pulse width indicating that a no-lock condition exists.

The Power Supply

In the power supply, two regulators are used. One serves the most critical component group, i.e., the frequency/phase detector, the vxo, and the vxo buffer, IC8A/B. The other serves a group containing the remaining components. All ground-return leads in each one of the two groups are returned to their common ground—and a heavy wire is recommended here. Fig. 5 presents the general arrangement of the power supply. Regulator #2 needs a bit of heat-sinking. At $V_{in} = +12$ volts, regulator #1 has to deliver approximately 50 mA to component group 1 while regulator #2 delivers approximately 330 mA to component group 2. Total power consumption is 4.6 Watts (12 volts at 380 mA).

Construction

The whole circuit was mounted on a perforated board of 68 × 100 mm (2-5/8" × 3-7/8") size with solder eyes and 0.1-inch spacing. The discrete components were soldered directly on the board in an arrangement which minimized the number of additional interconnecting wires. For the integrated circuits, wire-wrap sockets were used, and this part of the circuit was wire-wrapped.

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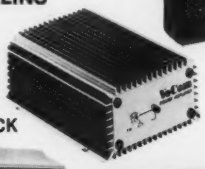

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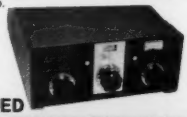

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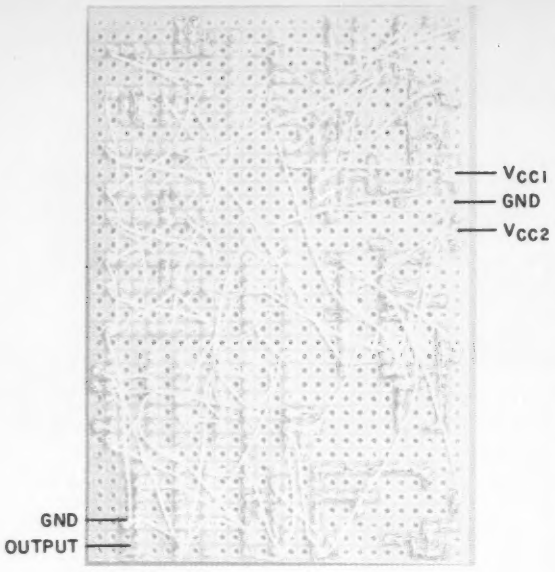
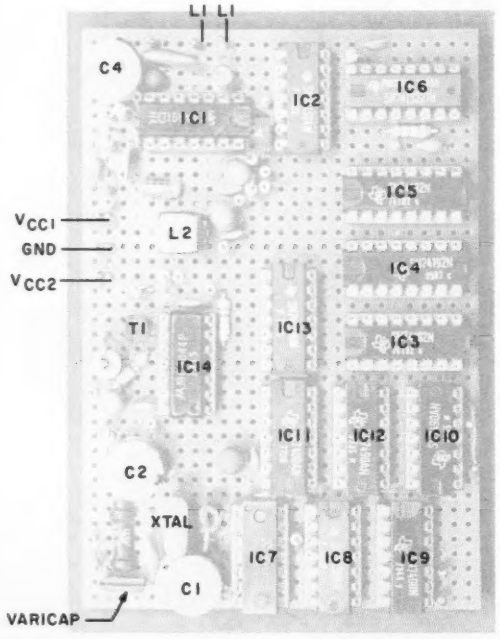


Bottom side of board.



Top side of board.

were inserted in the perforated board where needed. The whole circuit board may be mounted in a miniature cabinet 71 mm long × 102 mm wide × 28 mm high (2-3/4" × 4" × 1-1/8"). In this case, both regulators are mounted directly on the inner surface of the cabinet. However, the board may be installed directly into existing equipment. In case of a metal cabinet, the ferrite antenna must be mounted externally.

Alignment

The test instruments used for alignment were a VOM with an internal resistance of 20k Ohms/volt, a Sabtronics model 8610A frequency counter with an HP 10006 A 10:1 test probe (14 pF/10 megohms), and a small pocket receiver to check whether the broadcast station to be utilized is on the air.

First, the receiver is aligned by measuring its agc voltage at TP3 and tuning the input and output circuit of the receiver for maximum agc voltage. The negative agc voltage should be at least 0.6 volts and may run as high as several volts depending on the strength of the AM station received. The component values shown in the schematic diagram were chosen to receive a station on 756 kHz.

With the frequency counter at TP4, one should obtain a stable indication of the carrier frequency of the AM-broadcast station selected. If the display is not stable within one bit of the last digit of the frequency counter, make sure that the counter is not disturbed by residual modulation of the carrier, line noise, or other signals.

Next, program the appropriate number into the three count-down counters (IC3-IC5) which follow to obtain a 10(9)-kHz reading on the frequency counter at TP5.

Now connect the frequency counter to TP1 and the VOM to TP2 and adjust C1 so that the frequency counter displays 10-20 Hz more than 10 MHz (if the VOM indicates more than 3 volts) or 10-20 Hz less than 10 MHz (if the VOM indicates less than 3 volts initially). Allow the frequency/phase detector up to 30 seconds to recover from saturation and observe the VOM. The error voltage measured at TP2 should stabilize at about 3 volts within 60 seconds with the unlock indicator turned off and the frequency counter displaying 10,000,000 Hz, 9,999,999.9 Hz, or an overflow to (1)0,000,000.0 Hz depending on its accuracy. If the error voltage stabilizes elsewhere, adjust C1 of the vxo to achieve an indication of 3 volts.

Finally, adjust C1 so that an error voltage of 3.2 volts is indicated. This finishes the alignment of the circuit.

Performance

The performance measurements were made with the same test equipment already used for the alignment of the circuit. First, the frequency counter together with the 10:1 test probe was checked. An undesirable sensitivity of its internal clock generator to TTL signals at its input could not be found. However, it was sensitive to heavy line noise, so a 12-volt car battery was used to power the frequency counter.

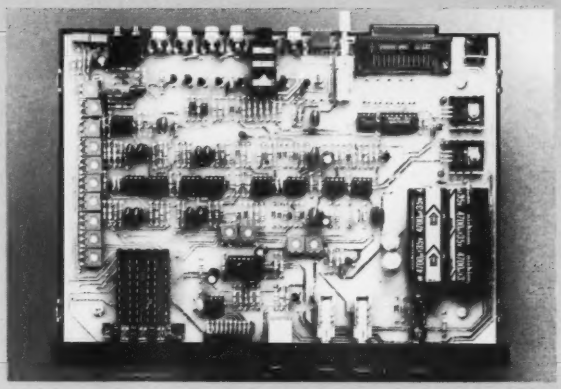
The frequency counter had an internal voltage regulator for 5 volts, but no drop of battery voltage occurred during the time of measurement. After warm-up, the counter was connected to TP1 of the circuit and its internal clock aligned for a display of 10,000,000 Hz for a measuring period of 1 second. Then it was aligned for an overflow to (1)0,000,000.0 Hz (representing 10,000,000.0 Hz) using a measuring period of 10 seconds. Using this test setup and applying a VOM to TP2, the following performance measurements were made:

1) The frequency counter displayed no other values than (1)0,000,000.0 (overflow) or 9,999,999.9 during more than one hour of measurement and for consecutive measuring intervals of 10 seconds at room temperature.

2) No other values than (1)0,000,000.0 (overflow) or 9,999,999.9 were displayed for intermittent shorts of the 10-MHz output terminal to ground. Also, the error voltage of 3.2 volts at TP2 remained constant in this case.

3) No other values than (1)0,000,000.0 (overflow) or

CHAMPAGNE RTTY/CW on a Beer Budget



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9,999,999.9 were displayed for ambient temperatures of 3° C (refrigerator) or 50° C (stove). No significant change of the error voltage at TP2 was noticed. (The measurements were made quickly after the 1-hour cooling/heating procedure outside the refrigerator/stove since their metal cabinets prevented the circuit from receiving the AM-broadcast station.)

4) No other values than (1)0,000,000.0 (overflow) or 9,999,999.9 were displayed for a change of V_{in} in steps of 10 volts in the range of 7-27 volts.

5) If the circuit is operated employing the European raster of AM-broadcast frequencies, phase modulation of the 10-MHz signal may be expected due to the quasi-periodic/aperiodic operation of the divide-by-1.111 · · · module. However, due to the long time constant of the low-pass filter following the output of the frequency/phase detector, ac components of the error voltage are filtered out to a large degree and a low phase modulation of less than 4% peak-to-peak was measured with an oscilloscope.

6) The output frequency settled to a display of (1)0,000,000.0 (overflow) or 9,999,999.9 within 60 seconds after power was applied to the circuit.

7) The circuit is sensitive to heavy line noise which in severe cases requires additional line filtering in front of the power supply. It also is sensitive to major disturbances of the AM signal. For example, during a thunderstorm the frequency of the 10-MHz output signal dropped by some Hz several times but recovered within a few seconds. A complete loss of the AM signal causes a drop of the output frequency to the lower bound of the phase-locked-loop capture range on the order of 100 Hz below 10 MHz.

Parts List

Integrated Circuits			
1	MC4044P (Motorola)		$5.00
1	SN74LS221N	(Quest Electronics)	1.19
1	SN7414N	(Quest Electronics)	.55
1	SN7400N	(Quest Electronics)	.19
4	SN7490N	(Quest Electronics)	1.40
3	SN74192N	(Quest Electronics)	2.37
1	SN74C00	(Quest Electronics)	.35
1	SN74LS00N	(Quest Electronics)	.25
1	TAA991D (Siemens-Ref. 2)		2.50
2	7805C regulators (R.F. Electronics)		2.78
Crystal			
1	10-MHz crystal (Quest Electronics)		3.95
Semiconductors			
1	LED, red TO-18 (Quest Electronics)		.15
1	Transistor BC170 or equivalent		.20
1	Varactor diode BB104gn or equivalent		.50
1	Diode 1N4148		.10
IC sockets			
4	Wire-wrap, 16 pin (Quest Electronics)		2.28
10	Wire-wrap, 14 pin (Quest Electronics)		5.50
Resistors (all 1/10 Watt)			
1	560 Ohm		
3	1k Ohm		
1	5.6k Ohm		
2	8.2k Ohm		
1	10k Ohm		
1	12k Ohm		
3	15k Ohm		
1	47k Ohm		
1	120k Ohm		
1	22 megohm	Total for all	1.20
Capacitors			
(15 V except where indicated)			
1	10 pF		.12
1	22 pF		.12
1	160 pF		.12
1	680 pF		.12
1	560 pF		.12
1	1 nF		.15
8	10 nF		1.60
1	10 nF/50 V		.40
1	22 nF		.30
1	.68 uF		.40
1	1 uF, electrolytic		.40
3	6.8 uF, electrolytic		3.00
1	6.8 uF/50 V, electrolytic		1.00
1	10 uF, electrolytic		1.00
1	47 uF, electrolytic		1.00
1	220 uF, elctrolytic		1.00
2	Trimmer capacitors 10-60 pF		1.00
Other			
1	Ferrite rod 115 × 8 mm (R33-050-400)		1.95*
1	Perforated board		1.80
1	Miniaturized filter (L2) (L-43-1)		1.50*
1	1-mH choke		.50
16	Terminal posts for board		.50
	Wire, solder etc.		1.40
			$49.96

*Amidon Associates, 12033 Otsego St., North Hollywood CA 91607.

Conclusions

As it was considered unlikely that during the performance tests variations of the output frequency of the circuit were counterbalanced by identical errors of different sign of the frequency counter, the following conclusions were drawn:

- The circuit can provide a 10-MHz reference frequency with a short-term stability of at least 0.01 ppm and a much higher long-term stability.
- Its accuracy and stability are directly dependent upon the quality of the AM-broadcast signal used as a reference frequency. Most AM-station frequencies are accurate to this and even to a higher degree.
- In contrast to a vxo in a thermostat, the circuit needs no warm-up period, it has no drift due to aging, it provides at least one order of magnitude better stability, and it does not cost more.
- It also has all the provisions necessary to accommodate a 9-kHz raster of broadcast frequencies if the FCC should go along this way in the future.

Use the circuit as an external reference, install it as the main clock in the existing space of your frequency counter, or use it as a calibration standard for your station. In every case, you are bringing a degree of frequency accuracy and stability to your ham shack which is maintained for you by other people day and night and brought to your home free of charge. Enjoy it! ■

References

1. Hetzel, P., "Empfang der Normalfrequenz des Traegers von DCF77," *Physikalisch Technische Bundesanstalt*, Braunschweig, Fed. Rep. of Germany, March, 1979.
2. Siemens AG, "Lineare Schaltungen," *Datenbuch 1974/75*, Band 2, Order No. B12/1213, Siemens Corp., Components Group, 186 Wood Avenue South, Iselin NJ 08830.
3. Texas Instruments, *The TTL Data Book for Design Engineers*, Second Edition, Marketing and Information Services, PO Box 5012 MS 308, Dallas TX 75222.
4. Motorola, Inc., *Phase-Locked Loop Systems Data Book*, Second Edition, August, 1973, PO Box 20912, Phoenix AZ 85036.

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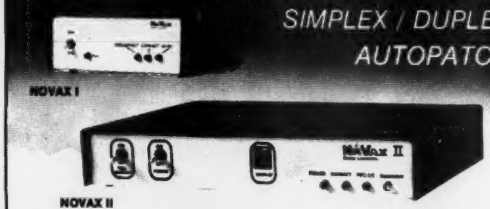

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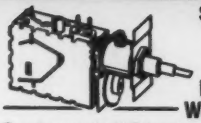

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3. The tuner is then fed a standard 10db 300 ohm antenna input and while monitoring the output on our HEWLETT PACKARD spectrum analyzer, the tuner is tuned to the desired channel and its oscillator is offset for the desired output frequency as follows:

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This procedure was developed by GILCO and it is our computer derived performance charts that make our tuner better, that's because ***almost every tuner gets a different value coil*** before it's peaked and again a different value coil after it's peaked. The combinations are endless and ***the way we determine the values is our secret...***

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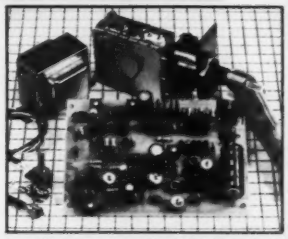

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PRINTER OUTPUT: Uses standard VIC printer for "Hard-Copy" of both receive and transmit data regardless of on-the-air mode. Also has hi voltage transistor switch on board for driving current-loop type printers.

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SPLIT-SCREEN: Displays text buffer input above and receive/real-time transmit text below the split line.

TOP LINE DISPLAY: Constant display of Time, Mode, Speed/Code in use, and status indicators.

TEST MESSAGES: Quick brown fox and RYRY's in Baudot, U*U* in ASCII, and VVV in Morse.

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T/R(PTT): Fully automatic control of your XMTR via the Push-to Talk line in both RTTY and Morse.

UN-SHIFT on SPACE: Automatically shifts back to "LETTERS" upon receipt or transmission of a Baudot space. Keyboard command on/off.

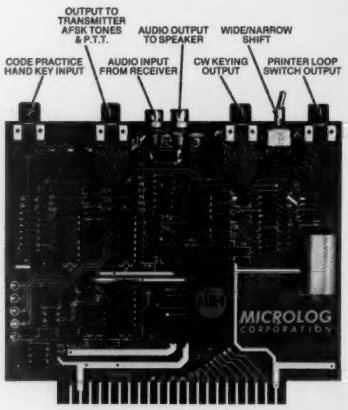
SYNC: Transmits "Blank Fill" in RTTY and BT in Morse when the text buffer is empty and unit is in transmit. Keyboard command on/off.

OUTPUT MODES: CHAR — outputs each character as typed. WORD — outputs full word when spacebar is typed. LINE — outputs full line when carriage return is typed. BUFFER — outputs full buffer, on command.

REAL-TIME CLOCK: Uses the VIC's internal clock for constant on screen display of time which can be inserted into text buffer on keyboard command.

WORD WRAP AROUND: Prevents splitting words at the end of a line. Works in receive as well as transmit.

MORSE TONE DETECTOR: Single tone, 800 Hz center frequency, with effective bandwidth of 300 Hz. Pitch reference regenerated audio tone for easy tuning.



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William B. Jones KD7S
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Build the Billboard Keyboard Keyer

Get perfectly-timed CW without a buffer. Then join the crowd at 60+ wpm.

Amid a flurry of activity to make modern amateur radio equipment extremely sophisticated, there are some indications of a welcome trend in the opposite direction. This is evidenced by the popularity of direct conversion receivers, low-power transmitters, and, in some instances, keyers. Magazine editors are begging for manuscripts describing equipment the average amateur can build without a laboratory full of expensive test gear or an engineering degree in solid-state physics.

One area which has not felt the full impact of this simple design philosophy has been that of the keyboard keyer. Some attempt has been made in this direction, but it has fallen far short of most people's expectations.

One early example of a rather uncomplicated device appeared in *CQ* a few years ago.[1] Unfortunately, there was a flaw in the design which would have rendered the unit inoperable had the builder not seen a following article describing an add-on memory which was published in a subsequent issue of the same magazine.[2] The same author more recently described a fairly simple keyboard keyer which appears to have whetted the appetite of many home-brew artists, judging from the number of units heard on the air recently.[3] Even so, this most recent design requires some fourteen integrated circuits which would intimidate the less experienced builder in most cases.

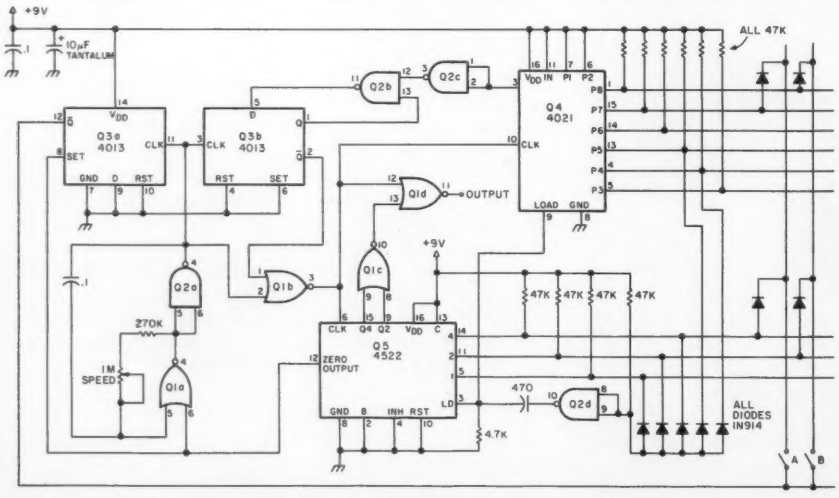

Fig. 1. Schematic of the "Billboard" keyboard keyer. Integrated circuit Q1 is a CD4001B and Q2 is a CD4011B. Although not shown on the schematic, pins 14 of these chips should be connected to +9 volts and pins 7 should be grounded.

Described here is a keyboard keyer which requires only five commonly available CMOS integrated circuits. It is capable of generating all letters, numbers, punctuation, and special characters such as AR, BT, SK, and AS. The keys are electronically disabled during character generation, which eliminates disrupting that character once it has been initiated. Further-

more, automatic letter spacing has been built into the design so that sending machine-perfect CW is no longer a rich man's game.

The last two features, keyboard lock-out and automatic letter spacing, are extremely important considerations when you give some thought as to how they are used. Take the combination "CQ" as an example. The operator momentarily depresses the "C" key and that character begins. He may then immediately depress the "Q" key and hold it down until the letter "C" and the space following it have been completed. Then and only then will the letter "Q" begin, at which time the operator releases the key and a perfect "CQ" will be generated. With very little practice, this method can be used for all words transmitted, thus reducing or eliminating altogether the need for expensive and complicated buffer memories.

It is my opinion that buffers do nothing more than compensate for poor typing ability in much the same way some operators use linear amplifiers to compensate for poor operating practices. If you are loud enough, somebody will surely answer you. If the operator is willing to practice for a bit with a bufferless keyboard, it is quite easy to fool other keyboarders into believing you actually do have such a buffer installed. Enough said.

Finally, no provisions for automatic word spacing have been included, as it was not felt necessary. Most operators can simulate near-perfect word spacing by ear. Again, this results in a meaningful reduction in cost and complexity.

Design Philosophy

Simplicity by itself is worthless unless consideration to reliability has been given. We have all seen the deceptively simple design which works poorly or not at all. The author was determined that this device not fall into that category. For that reason, schematics and parts lists were circulated to selected amateurs who represented a cross-section of building abilities and experience. Each was encouraged to build his keyboard as he saw fit. In each case, performance was identical to that of the two originals I built. A defective capacitor caused one unit to operate erratically until the culprit was found and relegated to the garbage can. Another builder used integrated circuits of dubious heritage and experienced some problems when operating in high ambient temperatures. Barring this sort of trouble, others building this keyboard keyer should have absolutely no difficulty in getting it to work, perfectly, the first time.

Circuit Operation

A diode matrix is used to encode the keyswitches to information which the electronic circuitry needs to form Morse code characters. Some designers prefer to use toroid transformers for this purpose. It is a moot question as to which method is superior as both have advantages as well as disadvantages. Diodes were chosen here mainly for the high degree of reliability they afford. They are widely available and inexpensive as well.

Integrated circuit Q4 is a parallel in/serial out shift register. Its output (Q8) is used to control Q2C, Q2B, and Q3B which comprise a dash generator. Any time a logic zero is present at pins 1 and 2 of Q2C, a dash will be generated. Otherwise, only dots will be formed. Logic zeros are programmed into the shift register by placing a diode on the appropriate input line and strobing pin 9 (load) high. As the clock input of the shift register (pin 10) is pulsed, any logic zero programmed will eventually work its way to the output and cause a dash to be sent.

Integrated circuit Q5 is a programmable down-counter. It is preloaded to one number higher than dots or dashes in the appropriate Morse character. The purpose of this is to keep the keyed clock (Q1A and Q2A) running for the additional time necessary to complete the automatic letter spacing. The counter is preloaded in identical fashion to the shift register.

Gate Q1C enables the output gate, Q1D, in all cases except when the counter has reached the number one or zero so that the letter space will not appear as a code element.

The other half of the dual-D flip-flop, Q3A, per-

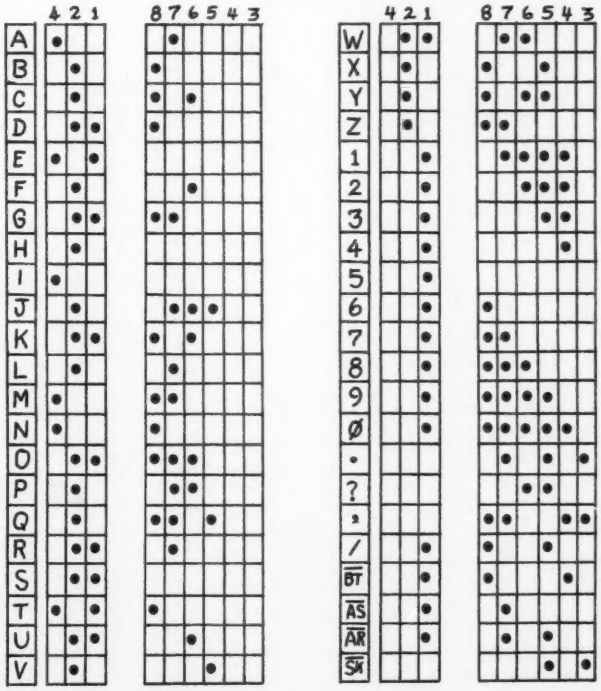

Fig. 2. Placement guide for diodes in the diode matrix. The first column refers to the CD5422 down-counter. The second column is for the CD4021 shift register. A dot indicates that a diode is to be placed in the appropriate line. All diodes are silicon switching types such as 1N914s or 1N4148s. The use of germanium diodes such as 1N34s is not recommended.

forms the keyboard lockout function by presenting a logic one to the common terminal of all keyswitches during character generation. Only after a character and its space are completed will the $\overline{Q}$ output go low, allowing another character to be started.

All this may seem rather complicated at first, but a couple of trips through the logic should bring everything together in short order. Consider each section separately instead of trying to visualize the action simultaneously. There are a lot of things going on at the same time, which may tend to confuse the reader who tries to understand the circuit as a single unit.

It can be seen from the schematic that everything is used. That is, there are no unused gates laying around doing nothing, no flip-flops standing idle. Nothing is wasted, which is one reason this kind of performance can be had with only five active devices.

The addition of a sidetone generator is left up to the individual builder. Most modern transceivers already have them built in. On the other hand, it is useful to have some method of monitoring your progress as you practice sending without the rig being activated. In my latest version, a Radio Shack Piezo Buzzer (part #273-060) was driven by a 2N2222A-type transistor and served the function of a sidetone generator simply and inexpensively. The singular drawback to this device is that the pitch is rather high for this application. Alternately, a 555 timer wired as an audio oscillator could be driven by a transistor in a similar manner to the Radio Shack device. Whatever method you choose, remember, the driving capability of CMOS integrated circuits is limited to extremely high impedance loads. Consult the *CMOS Cookbook* by Lancaster for additional information.

Transmitter keying is best done with a transistor instead of a reed relay to reduce the overall current drain. Since the entire keyer is capable of operating for extended periods of time from a single nine-volt transistor radio battery, it would be a shame to throw this feature away in order to use a relay. My rig is all solid state and requires keying a positive voltage to ground. Again, the 2N2222A was brought into play and performs the task well. For those rigs which require keying a high negative voltage to ground, something similar to the circuit used in the CMOS version of the Accu-Keyer should do well.[4] A recent paragraph in *QST* described a system which is designed to key both kinds of rigs without worrying about switching and could probably be adapted to this keyboard with little effort.[5] In any event, considerations should again be given to the limited current-driving capabilities of CMOS integrated circuits.

Construction

Due to the simplicity of the design, it was decided that no printed circuit board layout was necessary. Instead, the prototype models were constructed on perfboard using point-to-point wiring. This method has proven most satisfactory in this and other projects I have designed. One local builder used wire-wrap, which also worked out well although it was slightly more expensive.

Sockets were used for the integrated circuits to aid the builder should troubleshooting become necessary. The small additional cost is usually well justified, as many years of building experience has borne out.

The diode matrix is easily wired by running "lines" of number eighteen bare copper wire horizontally on one side of the board and vertically on the other. The author terminated the vertical wires with miniature flea clips purchased from the local Radio Shack store. Wires from the individual keyswitches were then soldered to the clips, resulting in a neat and orderly package.

Some number eighteen wire may tend to be springy and difficult to handle as it comes off the spool. By placing one end in a vise and pulling on the other end, the wire may be stretched slightly which will cause it to go limp and perfectly straight. Try this trick and you will be pleased with how well it works.

My unit was housed in a cast-off computer keyboard enclosure garnered at the local surplus emporium for a cost of under five dollars. An earlier version was built into a home-brew box which was not very attractive but quite functional. It is difficult to justify putting a twenty-dollar circuit into a twenty-five-dollar box with my limited budget. If that sort of thing doesn't bother you, there are some very nice commercial enclosures available. Just remember to make it metal for shielding the circuit from strong rf fields.

The actual keyswitches were purchased from Jameco Electronics of Belmont, California. They come as a unit molded into a plastic base thirteen inches long. Because I had need for only forty-four keys instead of the sixty-three supplied, the unit was cut down to ten and one-half inches long prior to wiring. This modification allowed space inside the enclosure for additional circuitry which will be described in a subsequent article.

As with any project, the finished unit is only as good as the parts which go into it. Cutting corners usually results in compromised operation. If a silver mica capacitor is specified, use one. The same applies to tantalum capacitors. They were chosen for a reason. Also, wherever possible, use "B" series integrated circuits as they are more reliable and better suited for this application. The erratic operation in high ambient temperature environments discussed earlier was cured by switching from "A" series to "B" series chips from a reliable vendor. Nine-volt transistor radio batteries are ideal power sources for CMOS designs. However, one should take care to get a quality unit. Don't waste your money on the dimestore cheapies. Don't rob the one out of the kid's handie-talkie. Buy a fresh alkaline cell for best results. It is money well spent.

If there is a keyboard keyer in your future but the family budget won't allow the several hundred dollars a commercial job requires, consider rolling your own. You will be the winner all the way around in dollars saved and pride of using a piece of equipment you built yourself. As an added bonus, most keyboarders find their code speed increasing steadily and rapidly. Perhaps the "Billboard" described here is the key to an Extra class license for you. ■

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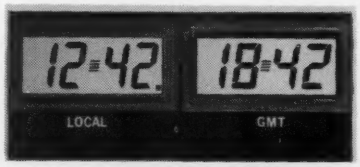

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Construct the Lead-Foot Key

If you like your CW in the fast lane, you'll love this key. And it is guaranteed not to slip—at any speed.

Editor's Note: Melting lead can be dangerous! Not only can you get burned, but the fumes can be toxic, too. Use caution and plenty of ventilation.

J. H. Owens W5JQE
R.e. 1, Box 218-T
Pottsboro TX 75076

Have you ever considered building your own keying-paddle, only to be stopped short by lack of a heavy metal base? Me, too. Then, one day after eating some sardines, I was about to throw the can away, when I took a second look and got a great idea. Why not fill the sardine can with melted lead and use it for the base?

Thinking about it for a while, I could find no flaws, so I scrounged some used automobile tire-balancing weights and melted them into the can with my propane torch. The metal clamps floated to the surface where I picked them off with pliers. The sludge also floated to the surface, and I scraped it off with the lid from the can. (A friend of mine used lead pipe and melted it in the can over a kitchen range burner. But, before that, he drilled a hole in each end of the can, and put a sheet metal screw through it, this to hold the lead casting and the can securely together.) So far, so good.

After the lead-filled can cooled down, I washed off the traces of sardine oil with solvent (you can use lantern fuel, paint thinner, acetone, etc.), then roughed the surface with fine sandpaper, and gave it a coat of paint. Not bad. The upside-down can was smooth and nicely contoured. Heavy too...it weighed four pounds.

A little later on, I found that it was also very adaptable for mounting the keying hardware. All I had to do was drill pilot holes through the can and into the lead casting—*very slowly*. If you don't have a hand-drill or variable-speed electric drill, use your regular electric drill, but turn it on and off repeatedly to keep it from running fast. I used a #4 drill, 3/32" in diameter, and kept it oiled. Now I was able to mount the parts with #6 × 1/4" sheet-metal hex-head screws. Neat.

The finished model with glass-epoxy paddle arms, which give it a "hard" feel, like the commercial paddles. Phenolic arms are more flexible and give it a "soft" feel. If you like a really soft feel, make the arms an inch longer. Hey! If you don't like sardines, you can get smoked clams or oysters in the same size can!

The Paddle Arm

The biggest challenge I found in making the paddle arm was finding the right material. I went through the usual list of leaf switches, hacksaw blades, etc., only to find out that those

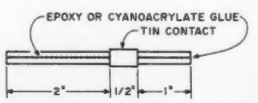

Fig. 1. Paddle construction. Clamp glued ends together until cement has cured. Use same technique for tin-plate ground contact.

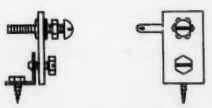

Fig. 2. Keying stanchions. To begin, gap the points at 0.010".

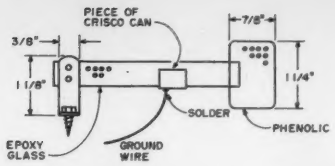

Fig. 3. Details of paddle-arm assembly.

springy gadgets have *minds of their own*! They keep on bounding back and forth after you want them to stop, and good electrical contacts they ain't. So, after many trial-and-error experiences, I got down to some basic reasoning.

What I really needed was a lightweight material, having low mechanical Q, or high damping factor, something rigid in one plane and flexible in the other. But what? Then it hit me. How about a strip of perfboard or, better still, *two* pieces? After some experimenting, I ended up with two strips of 3/64" (0.0468) glass-epoxy board, about 5/8" wide and 3½" long, glued together at the last half-inch on each end with epoxy cement. You also can use cyanoacrylate cement. See Fig. 1.

This assembly provided the desired damping factor, and more. Let me explain. When you bend the arm, one of the perfboard pieces is *stretched* and the other one is *compressed*, and the friction between the two absorbs the stored kinetic energy quickly. If you want to test this, clamp one end in a vise, and flick the other end with a finger. Listen closely, and note the time it takes for the vibration to stop. Now try this same test with a hacksaw blade and you will find that the vibrations last *ten* times as long. No minor difference here, but a major improvement. OK?

The Dit-Dah Electrical Contacts

Still another challenge was finding a satisfactory substitute for the precious-metal contacts used on the finer commercial models. No big problem with the stanchion contacts—6-32 nickel-plated brass screws, about one inch long, worked OK. I made the stanchions by cutting a terminal-strip into two pieces, and mounting them to the base with half-inch angle brackets. See Fig. 2.

The common, or ground contact, on the paddle arm was a little trickier. The best thing I could find was shiny tin-plate, such as used for Crisco and other hydrogenated vegetable-oil cans. S-o-o-o, I raided the refrigerator and transferred the cooking grease from its container into a plastic storage box. Then I cut off a piece of the can material about a half inch wide and an inch long, cleaned all the grease off it, bent it around the paddle arm, and glued it in place. See Figs. 3 and 4.

Next, I soldered the flexible ground wire to the bend point. Finally, I sprayed the contact surface for lubrication and corrosion resistance. . . WD-40 or TV tuner spray works well. Voilà! Soft-touch contacts. Not gold, but so much *much* better than blued steel.

The Non-Slip Feet

One thing I hadn't planned on was a 4-pound paddle slipping around on my operating desk, even with rubber feet on it. I talked with some other hams and they told me that they had the same problem with their bugs and paddles. Some glued them to their desks, others drilled holes and screwed them down.

Well, I kept trying different things until one day I hit the jackpot with polyurethane foam. This is the stuff used for cushioning fragile items for mailing. It also is used as weatherstripping tapes. It worked, beautifully. Dime-size pieces, about one-quarter inch thick, glued to the lead base, did the job. The final choice was two strips, about a half inch wide, glued with rubber cement along each underside of the base. This stuff works on the commercial paddles, too. Just slip a little piece under each one of the rubber feet to make contact with the desk surface. I know, because I own one of those commercially-built paddles, a fine piece of precision machinery.

So, why did I go through all of this work to build a paddle? Well, the problem is that the manufactured paddle is *iambic*, and I am *non-iambic*. That's incompatibility. I just couldn't avoid closing both the dit and dah contacts at the same time, too often in the wrong order. Mistakes, mistakes, mistakes. So, I decided that the "squeeze" system, as well as the squeeze paddles, were not for me. Unfortunately, I could find no non-squeeze, non-iambic paddle on the market. So, I built my own. Maybe this article will stimulate some manufacturer to take a step *backward*. Anything to cut down on the keying mistakes on the air would be a blessing.■

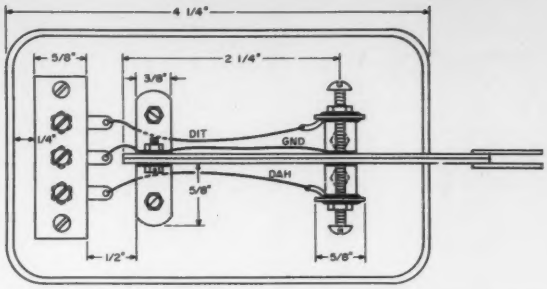

Fig. 4. Top view of the completed key. The dimensions were measured on one of the models, but need not be exact.

Hardware for the key. The contact stanchions were made from a second terminal board (same as the one on the left) cut into two pieces. The angle brackets for the contact stanchions shown had pierced-and-threaded holes, but their base ends had to be cut off to leave only one hole. Ordinary 1/2" × 1/2" angle brackets would serve as well. The sink-faucet washers may be glued to the base to raise it higher if desired. The sheet metal screws for the terminal board have to be 1/2" to 5/8" long to account for the standoff spacers.

Phil Anderson W0XI
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The $2 Infinite-Memory Keyer

Take a break. Your cassette recorder will send any message for you.

If you have a cassette tape recorder and like to operate CW, you can add an infinite memory keyer to your station for about two dollars. The idea is to place your CW messages on cassette tapes and play them back to key your transmitter. The demodulator presented in this article will convert the CW tones from the tape player into keying signals to drive the transmitter.

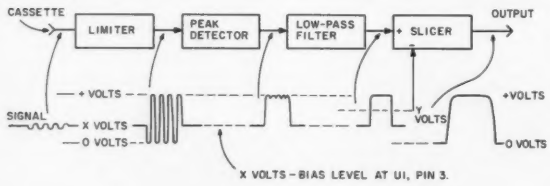

Fig. 1. Cassette memory keyer block diagram.

For repetitive messages such as CQ CQ DE . . ., you can use a continuous cassette tape. These come in 1/2-, 1-, 2-, and 3-minute durations. The tape in the cassette is looped back on itself and thereby forms a continuous tape. For code practice or message broadcasts, the usual C15, C30, or C60 cassettes could be used.

Code can be placed on a cassette by using an audio oscillator or your transmitter sidetone. Best results are obtained if the code is transmitted directly from the oscillator circuit to the mike input of the cassette tape recorder rather than recorded by microphone pickup. Too much background noise results from the latter.

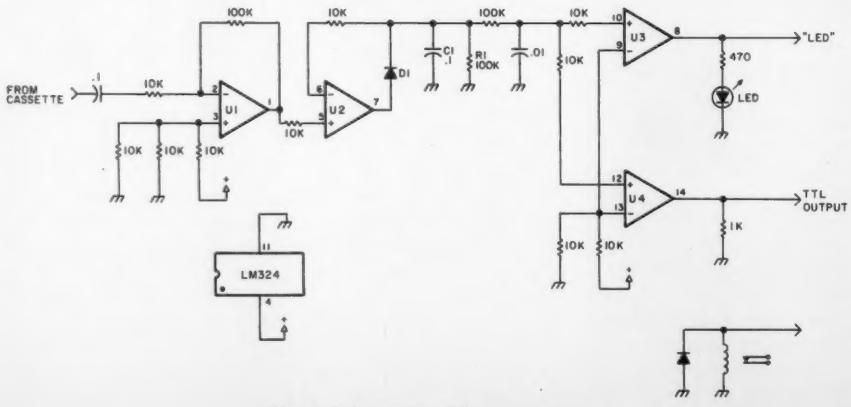

Fig. 2. Schematic of keyer system.

Demodulation

Before presenting the cassette keyer, let's look at the general demodulation process. As shown in Fig. 1, it consists of four steps: limiting, peak detecting, low-pass filtering, and slicing. The limiter is used to amplify the cassette CW tones and to provide sufficient drive for the peak detector. Also, the limiter will smooth out any small variations in the amplitude of the tones. This process is similar to FM detection ex-

cept that the filter or discriminator is discarded.

The peak detector is set to convert the limited tones to positive-going pulses. It acts as a half-wave rectifier but retains the positive peaks for a short duration; hence, the pulses have a slight ripple pattern at their tops. The circuit ignores the negative-going portions of the tones.

The low-pass filter is then added to remove these ripples. The system will work without the filter as long as input tones are clean and strong. It aids operation, however, when tape output is marginal.

The slicer converts the peak-detected pulses into TTL-compatible signals that go from 0 volts in the off state to about 3.5 volts in the on state.

Circuit Schematic

Now, let's examine the circuit schematic, Fig. 2. All of the signal processing is done with a single operational amplifier chip, an LM324, which contains four separate op amps. The circuit can be operated from a 5- or 9-volt dc supply. All resistors are 1k, 10k, or 100k, with the exception of one 470-Ohm resistor.

Circuit Operation

Cassette tones enter at the left and the TTL-compatible output is at bottom right. The circuit can also drive a low-voltage relay if it is substituted in place of the 1k output resistor at pin 14.

The limiter, U1, has a gain of ten and is biased at pin 3 to one-third of the supply voltage. This bias also sets the dc voltage level at pins 1, 5, 6, 10, and 12.

The peak detector, U2, charges capacitor C1 to the peak voltage of the tones that appear at pin 5. When the voltage at pin 5 exceeds the voltage on C1 and hence also at pin 6, U2 forward biases diode D1 and further charges C1. When the voltage at pin 5 drops, U2 turns off and C1 holds its charge until the bleeder resistor, R1, discharges it. C1 and R1 are set so that the ripple at C1 is small but the pulse formed from the code signals follows the code quickly; this is always a compromise.

The ripple is then removed by the RC low-pass filter. It does a sufficient job and frees up the fourth op amp in the LM324 IC to be used as a tuning indicator.

U3 and U4 work as slicers, or comparators, and convert the pulses from the peak detector into TTL-compatible signals. A dc restore circuit could be used here as an alternative. The advantages of the slicer are that it cleans up some ripple that may still remain and generates sharp and clean rise and fall edges for the keying output. The bias for U3 and U4 is set about one volt above the bias for U1 and U2. Therefore, when a pulse is generated at U2, the voltage crosses over the bias voltage of U3 and U4, generating positive pulses at their outputs. That is, when the voltage at pin 12 exceeds the bias voltage at pin 13, pin 14 will have an output nearly equal to the supply voltage.

The output of U3 is used to drive an LED indicator. This makes tuning and circuit verification of proper operation easy. The circuit as a whole could be used for receiver CW demodulation if a CW filter is placed between U1 and U2. You may want to consider that when planning circuit construction. Happy cassette keying! ■

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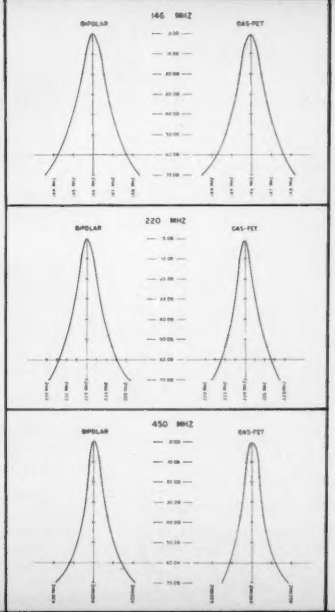

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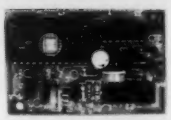

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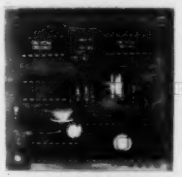

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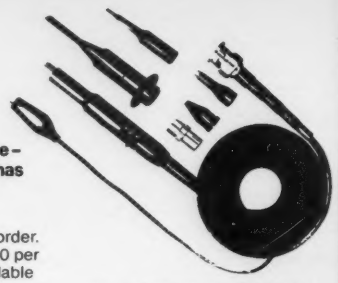

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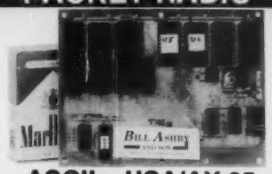

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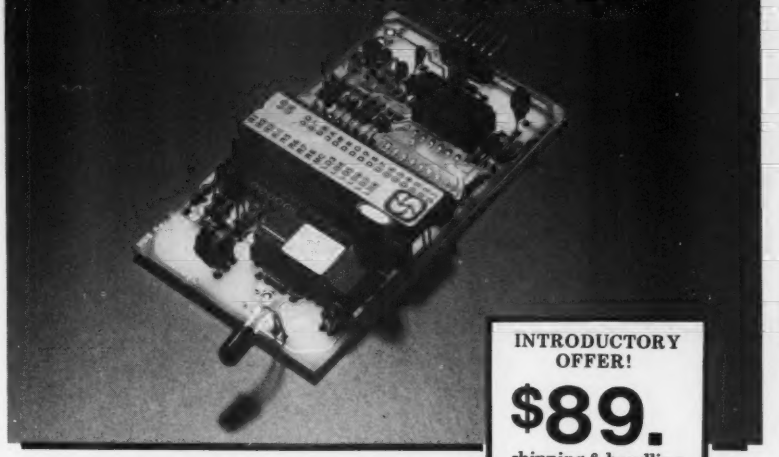

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Lines 1000 to 1460 contain the Morse data. The data lines consist of the ASCII value for the character followed by a Morse representation. A 3 signifies a dash, a 1 stands for a dot, and a 0 marks a space. For example, line #1110 says the following:

1110 DATA 65,130

The number 65 is the ASCII code for an uppercase A. The 130 means didah, followed by a short space to keep it from running into the next letter.

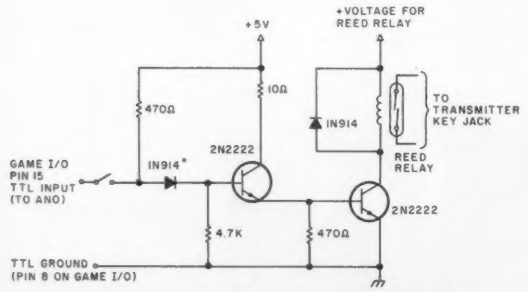

*Fig. 1. No parts values are critical. *Any small switching diode can be used.*

When the program is run, the computer will take the data listed between lines 1000 to 1460 and load it into the string matrix CODE$. The location within CODE$ is the ASCII value of the character; in other words, location 65 in CODE$ contains the data for the Morse letter A. When characters are sent to the computer from the keyboard, the computer changes the letters to their ASCII value (using the BASIC ASC($) command) and looks in CODE$ (<ASCII value of letter>) for the Morse data. The Morse data is then dissected character for character using the BASIC MID$(X$,X,X) command.

Lines 80 to 90 are for the CW sidetone. These lines POKE a machine language subroutine which will enable the Apple to send the CW through the internal speaker. The value POKEd into decimal location 768 on line 70 determines the pitch of the sidetone.

Line 130 gets a single character input from the keyboard. This character is then checked to see if it is a control character used for a special purpose on lines 140 to 160. In this program, the control characters A, B, Y, and Z are used for special functions.

The subroutine at line 200 is what takes the Morse data from the proper location in CODE$ and generates the Morse signal from it. The Morse character can be heard on the Apple speaker. Also, the annunciator TTL output number 0 will be toggled on and off in Morse code. This signal

can be used to drive your transmitter through a suitable driving circuit. The circuit used must take the TTL output and use it to drive a reed relay which, in turn, keys the transmitter. An example of such a circuit is shown in Fig. 1. The lines which turn AN0 on and off are located at line 235 and line 245. Line 240 is a call to the machine language sidetone routine.

Using the program is a simple procedure. When the program is run, the screen will clear and the following will appear:
MESSAGE—>

After this prompt, type in a message for the memory. This message can be played back at any time while in the keyboard mode of operation by simply pressing either CTRL A or CTRL B. The message may be up to 254 characters in length. If the message contains commas, enclose it in quotes.

The next thing to appear on the screen is:
SPEED

Type in a number between 1 and 85. Note that 85 is the *slowest* speed. The fastest usable speed is about 6. At speeds faster than this, the transmitter does not key accurately. When set for a speed of 7, the code speed as measured on a Kantronics Field Day II code reader was in excess of 75 words per minute.

After the above two items are entered in, the program will operate as a CW keyboard. When a letter is typed on the keyboard, it is sent through the speaker and AN0 in Morse code and displayed on the monitor. If you want to play back the pre-programmed message, hit control A or B. To reset the speed, use CTRL Z. If you want to change the message, hit the CTRL Y keys.

I gave the following keys special functions: ESC produces the Morse error code (eight dits), and the colon (:) is the CQ key. To add a special function to any key of your choice, all you must do is determine the ASCII value of the character and put it on a DATA line followed by the Morse representation of what you want sent. For example, if your name were Joe and you wanted the computer to send your name whenever CTRL N was pressed, you would add the following line:

DATA 19, 1333003330010

The line number can be any unused one, as long as it comes before the end of data marker at line 1460.

Because of the structure of this program, it is quite easy to make some useful changes. One thing that would be quite easy to implement would be to have the program output American Morse instead of International Morse. To get the longer dashes used in Continental code, use a 4 or a 5 instead of a 3 for the dash character. This will limit the top speed number that can be entered in to a 51. It also would be necessary to change the *end* of line 50 to read:
IF S * 5>255 THEN 50

This is needed to accommodate the longer dash character.

I hope you will enjoy using this program. If you own a micro other than an Apple II, you can use the same fundamental program as long as your BASIC contains string manipulation functions. The sidetone and keying of the rig will vary greatly on different types of computers. ■

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Program Listing.

```
1 Q9 =  PEEK (49240)! REM  TURN XMITTER OFF!!
5  REM !WRITTEN BY ROBERT SWIRSKY
10  DIM CODE$(128)
20  HOME
30  INPUT "MESSAGE---->";M$
40  IF M$ = "" THEN M$ = " "
50  HOME : INPUT "SPEED";S! IF S * 3 > 255 THEN 50
60  RESTORE
70  POKE 768,50
75  REM !SIDETONE
80  POKE 770,173! POKE 771,48! POKE 772,192! POKE 773,136! POKE 774,208! POKE
    775,5! POKE 776,206! POKE 777,1! POKE 778,3! POKE 779,240! POKE 780,9
    : POKE 781,202
90  POKE 782,208! POKE 783,245! POKE 784,174! POKE 785,0! POKE 786,3! POKE
    787,76! POKE 788,2! POKE 789,3! POKE 790,96! POKE 791,0! POKE 792,0
100  REM
110  GOSUB 310
120  HOME
130  GET R$
140  IF  ASC (R$) < 3 THEN  GOSUB 370
150  IF  ASC (R$) = 26 THEN 50
160  IF  ASC (R$) = 25 THEN 20
170 D =  ASC (R$)
180  GOSUB 280
190  GOTO 130
200  FOR X = 1 TO  LEN (CODE$(D))
210 G$ =  MID$ (CODE$(D),X,1)
220  IF  VAL (G$) = 0 THEN  GOTO 350
230  POKE 769,(S * ( VAL (G$)))
235 X9 =  PEEK (49241)
240  CALL 770
245 X9 =  PEEK (49240)
250  FOR X1 = 1 TO 3! NEXT
260  NEXT
270  PRINT R$;
280  FOR X1 = 1 TO S * 1.3! NEXT X1
290  RETURN
300  END
310  READ F,F$
320  IF F =  - 1 THEN  RETURN
330  LET CODE$(F) = F$
340  GOTO 310
345  REM !SPACE
350  FOR X1 = 1 TO S * 1.7! NEXT
360  GOTO 260
370  FOR H1 = 1 TO  LEN (M$)
380  LET R$ =  MID$ (M$,H1,1)
390 D =  ASC (R$)
400  GOSUB 280
410  NEXT H1
420 R$ = " "
430  RETURN
1000  DATA  49,133330
1010  DATA  50,113330
1020  DATA  51,111330
1030  DATA  52,111130
1040  DATA  53,11111
1050  DATA  54,31111
1060  DATA  55,33111
1070  DATA  56,33311
1080  DATA  57,33331
1090  DATA  48,33333
1100  DATA  32,00
1110  DATA  65,130
1120  DATA  66,311110
1130  DATA  67,31310
1140  DATA  68,3110
1150  DATA  69,10
1160  DATA  70,11310
1170  DATA  71,33100
1180  DATA  72,11110
1190  DATA  47,311310
1190  DATA  73,110
1200  DATA  74,13330
1210  DATA  75,31300
1220  DATA  76,13110
1230  DATA  77,03300
1240  DATA  78,310
1250  DATA  79,03330
1260  DATA  80,13310
1270  DATA  81,33130
1280  DATA  82,1310
1290  DATA  83,11100
1300  DATA  84,00300
1310  DATA  85,11300
1320  DATA  86,11130
1330  DATA  87,13300
1340  DATA  88,31130
1350  DATA  89,31330
1360  DATA  90,33110
1370  DATA  46,131313
1380  DATA  27,111111111
1390  DATA  13,31113
1400  DATA  44,331133
1410  DATA  38,10111
1420  DATA  45,31113
1430  DATA  58,3131003313
1440  DATA  63,113311
1450  DATA  18,13131
1460  DATA  -1,-1
```

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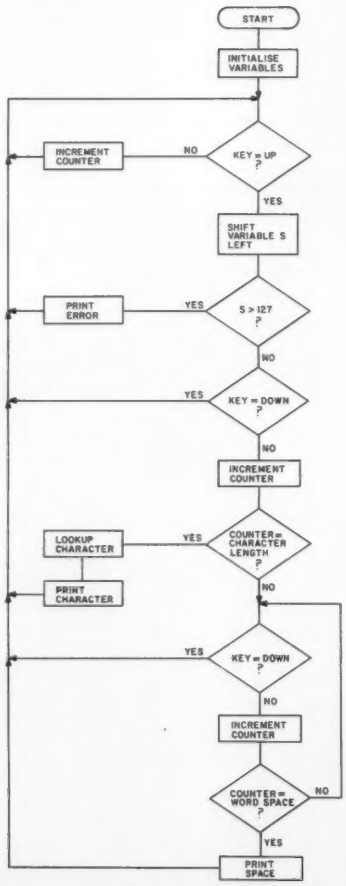
Micro McElroy

Is Pet BASIC fast enough for solid CW copy? You bet—and this program will work miracles with a sloppy fist.



Flowchart.

Mike de la Dette VK3BHM
79 Bedford Road
East Ringwood, Vic. 3135
Australia

Most CW reception programs are written in assembly language to optimize speed and efficiency. This is a good idea, but makes conversion of the program to run on another computer very difficult and time-consuming. Also, while many people are very proficient in high-level languages such as BASIC, not everyone is prepared to devote the time required to program directly in assembly or machine language.

Having written a routine in machine language to decode CW on my Commodore Pet™, it occurred to me to try a direct translation into BASIC. Would it work? Surely BASIC would be too slow and inefficient.

The results were very surprising. The routine is very short (under 500 bytes) and handles speeds of up to about forty words per minute. This limitation on speed is imposed by the BASIC interpreter in the Pet. Higher speeds could be obtained on versions of BASIC which employ a compiler rather than an interpreter. Armed with the BASIC listing and flowchart, anyone reasonably familiar with their machine's assembly-language instruction set should be able to write an equivalent machine-language program, if speeds in excess of 40 wpm are contemplated.

The memory location in my Pet for input/output is at 59471 (decimal). With a key connected between pin L on the user port and ground, the value obtained by PEEKing this location will change from 255 to 127. These values are set in line 5 of the listing. Variables U and D give the values for key UP and key DOWN respectively and variable P contains the input port address. You will need to change these three variables to match your computer's arrangements.

Variables F and T determine the receiving-speed

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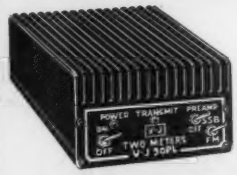

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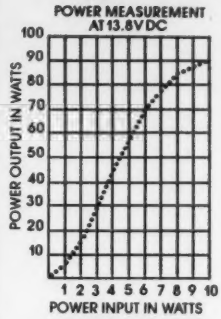

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"window" and are set in line 10. This gives a center speed of approximately 20 wpm on the Pet. As these values will vary according to the execution speed of your computer's BASIC, I have not supplied a conversion constant or table. You will need to experiment with differing values for variable F to obtain a constant which can be divided by the speed required to produce a new value for F. The algorithm used will decode CW over a wide range of speeds without altering these variables, but word spacing will suffer.

If using a hand key or electronic keyer directly into your computer, place a .1-uF capacitor across the key contacts to smooth out the inevitable bounces, especially if using a relay.

After trying things out on local copy, you will need to make up a demodulator to convert your receiver's audio into a signal which switches between ground and +5 volts. A one-IC PLL circuit is a good place to start and will cost very little. If you plan to use a RTTY demodulator, disable the limiter—hard limiting will bring up the background noise to the point at which copy is impossible. Also, you will not be able to use your receiver's CW filter if the demodulator is set up to accept only the standard 2125/2295-Hz RTTY frequencies. This is no great matter, but you will need to set your receiver to a somewhat higher-pitched tone than is usual for CW. Ideally, a separate demodulator with anti-noise circuitry, slow agc, and filtering centered around 1000 Hz should be used.

The algorithm used will cope with odd dot/dash ratios, "swing," and other irregularities. However, like most CW decoding systems, it is easily confused by very poor inter- and intra-character spacing. If the other guy's CQ sounds more like NNMA, then it's time to put your headphones on and switch over to the computer Ted R. McElroy used all those years ago. That's the one with enormous memory, fantastic speed, and incredibly complex I/O; you'll find it right under the headphones! ■

```
1 REM THIS LISTING EXPANDED FOR READABILITY
2 REM DELETE UNNECESSARY SPACES WHEN ENTERING
10 N=0: Q=1: F=2: T=3
20 P=59471: U=127: D=255
30 A$=" ETIANMSURWDKGOHVFILAPJBXCYZQOO54%3FF?2
40 A$=A$+"!.@....16-/...#.7...8.90.....*....U.?
50 S=Q
60 X=N: Z=N
70 IF PEEK (P)=D GOTO 100
80 Z=Z+Q: IF Z=T THEN X=X+Q: Z=N
90 GOTO 70
100 IF X=N GOTO 60
110 S=S*2: IF X<F GOTO 130
120 S=S+Q
130 IF S>127 THEN PRINT ".";: GOTO 200
140 X=N
150 IF PEEK (P) = U GOTO 60
160 Z=Z+Q: IF Z=T THEN X=X+Q: Z=N
170 IF X>F GOTO 190
180 GOTO 150
190 PRINT MID$(A$,S,Q);
200 X=N
210 IF PEEK (P)=U GOTO 50
220 Z=Z+Q: IF Z=T THEN X=X+Q: Z=N
230 IF X> F*2 THEN PRINT " ";: GOTO 200
240 GOTO 210
```

Program listing.

See List of Advertisers on page 114

T. K. Davies VE7DHD
Department of Chemistry
University of Victoria
Victoria, British Columbia
Canada V8W 2Y2

QRP Keyer for Misers

Get machine-perfect code with this keyboard. All it costs is 30 mW and a few dollars.

What on Earth is a QRP keyer? A very reasonable question. If you run a kilowatt, your keyer could draw five Watts, but if you run less than two Watts, you start looking for another keyer: a low-power, or QRP, keyer. Any keyer you have should be consistent with the power of transceiver that you are using. In my case, being a convert to the QRP doctrine, the keyer must be in the very low milliwatt range. Specifically, the following design draws 30 milliwatts and has nearly as many features as it has milliwatts.

Well, now that you are reading about QRP keyers, a word about why a low-power keyer was conceived.

The project was initiated for two reasons: one, to have a keyboard for portable and vacation operation, and the other, to have a good electronic keyer to use for the instruction of a Novice class. My experience with teaching code using a computer and seeing the advantages of properly-sent Morse at known speeds and intervals has confirmed me as a keyboard-keyer user. The problem was not that there were no circuits to do most of the above, but that they each had some good features and some undesirable ones.

In reviewing the more recent articles, several are of note. K1GN[1] describes an excellent keyboard unit which incorporates an instructor function that is capable of sending random five-letter groups with variable delay between characters. However, the method of encoding the Morse character with diodes is not appealing. Also, the lack of any type-ahead buffer would make the sending of Morse for extended periods quite trying.

Steber's[2] Morse-a-Keyer has many more desirable features. It has type-ahead, it has a simple encoding scheme, and it was designed with readily available parts. The major drawback is the use of a 1702A PROM to convert the ASCII to Morse. The ASCII keyboard, the PROM, and its associated negative voltage inverter consume 95% of the power required to run the keyer.

K2BLA's[3] unit offers a good solution to the problem of encoding the Morse characters—a scanned keyboard. However, the limited capability for type-ahead of only two characters is hardly in the realm of a unit for "armchair operation."

After this survey of keyboards, several criteria became apparent for a good portable/instructional keyboard:

- it must be low power
- it must have a type-ahead buffer
- it must have an accurate speed indicator
- the buffer must have a useful indicator of "how full"
- it must be small in size and self-contained
- it should have a store feature for preloading the buffer
- it should have an Escape key to quit operation if break is required
- it should have an indicator for battery condition
- it should have switchable sidetone

With this list of "desirable features," the QRP keyer was attempted and the following was the result.

Photos by E. Grambart

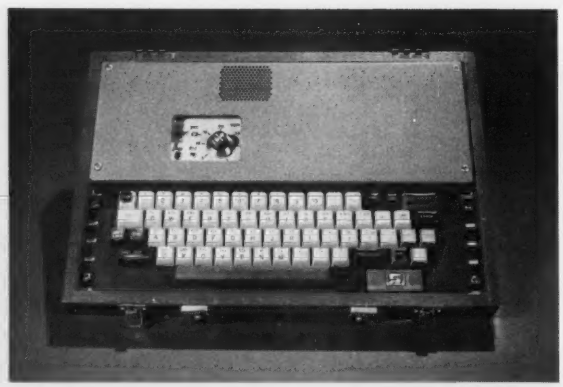

Photo A. Complete keyer with lid of case removed.

The Keyboard

The keyboard is a surplus unit with all the electronics removed. (Similar units are advertised in the $20-to-$25 range in this magazine and other amateur journals.) The keys, their mounting frame, and the PC are retained; all excess printed-circuit traces are cut away with a hobby knife and pliers, leaving only the keypads on the PC board.

The push-and-lock switches such as the shift lock and

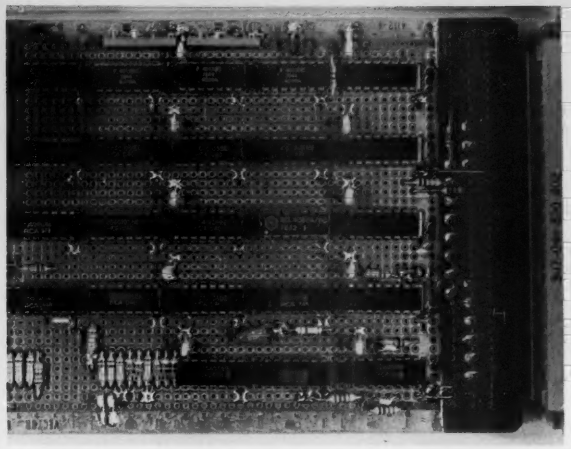

Photo B. Logic card—located in top right of case.

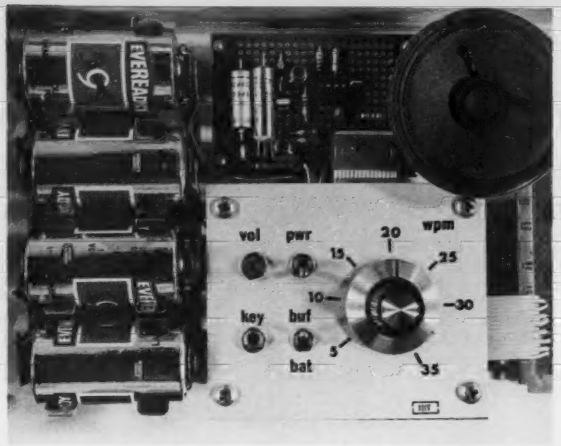

Photo C. Control panel, speaker, batteries, and sidetone/relay board.

similar functions were moved to the back row, as these are useful for analog functions which are described later. After all this carving of the PC board was done, the keyboard was rewired with small-gauge wire as outlined in Table 1.

Fig. 1 gives details and references for the following discussions. The keyboard encoder is a 16-by-8 matrix which allows for all of the common Morse characters to be encoded. Additional wiring is required for special characters and functions that are not encoded by the scanned keyboard but are essential just the same. These include Escape, Space, Tune, Speaker, Meter, and Store. The rewired keyboard is interconnected to the electronics card by a 50-conductor cable. I used a length of surplus telephone switchboard cable. (For a description of the operation of a scanned keyboard, see Reference 4, as this is the probable source of most scanned keyboards.) The QRP keyer's design extends the Lancaster keyboard to a 16-by-8 and also makes it a Morse unit rather than ASCII.

Type-Ahead Buffer

A highly desirable feature in a keyer is the type-ahead buffer, providing the ability to type on the keyboard at high speed and have the keyer send at a slower speed. With this capability, the timing of your letters and spaces is not tied to your uneven hunt-and-peck at the keys. The type-ahead in this keyer differs from previous units in that it has a segmented buffer. The 48-character buffer is in three parts, each of which indicates on a meter. While you are typing, the keyer keeps track of how much space has been used with each keystroke. When you are one-third full, the meter will indicate one-third full scale and multiples of one-third up to a full buffer at which time characters will be lost if you keep on typing. The 16-character type-ahead buffer in Reference 2 does not give meaningful indications as it only lights an LED when the buffer is full; you are left to guess whether it was the last key you pressed or one or several before.

I find that with the 48-character buffer there is little problem with overflow of the buffer. In practice, I type on the keyer until the meter indicates two-thirds full and then I finish my sentence and wait until the keyer empties the buffer to one-third or less and start typing again.

The circuit for indicating the fill of the buffer is straightforward. The data-in ready flag on the 40105 FIFO (first-in, first-out memory) indicates whether the particular 16-character segment is full. If it is full, the flag line goes low and this indication is fed via an inverting buffer to a summing network of all three FIFO segments. The summed voltage point of the three FIFOs is fed to a meter. The meter serves a dual purpose since it indicates the condition of the batteries when the switch is moved to the Bat position.

The Keyer

The heart of the keyer is the PISO section (parallel-in, serial-out). The PISO takes the parallel two 4-bit parts of the Morse word from the buffer and sequentially shifts these bits through a

Photo D. Keytops and meter (black keys have new tops).

Photo E. QRP station—QRP keyer and HW-8 (the keyer lid was removed to make a base for the transceiver).

	Octal	A	B		Octal	A	B
E	004	10	0	5	100	8	4
T	006	11	0	6	102	9	4
I	010	12	0	AS	104	10	4
				7	106	11	4
SP	011	special		8	116	15	4
N	112	13	0				
A	014	14	0	/	122	9	5
M	016	15	0	AR	124	10	5
S	020	8	1	KN	132	13	5
D	022	9	1	9	136	15	5
R	024	10	1				
G	026	11	1				
U	030	12	1	4	140	8	6
K	032	13	1	Brk	142	9	6
W	034	14	1				
O	036	15	1	3	160	8	7
H	040	8	2	2	170	12	7
B	042	9	2	1	174	14	7
L	044	10	2	0	176	15	7
Z	046	11	2				
F	050	12	2	Error	200	0	0
C	052	13	2	?	230	4	1
P	054	14	2	:	216	7	0
				;	262	5	1
V	060	8	3	SK	320	0	5
X	062	9	3	.	324	2	5
Q	066	11	3				
Y	072	13	3	()	332	5	5
J	074	14	3	,	346	3	6

Table 1. Keyboard rewiring. A = the 16 rows of the keyboard matrix and B = the 8 columns of the matrix. All like numbers of the rows are connected together and likewise all the columns, and then each set is connected to its appropriate 4051 scanner.

set of four dual flip-flops (ICs 10, 15, 19, 23), testing for dots, dashes, spaces, or whether the last element of the word has been sent. The space character is not, of course, a Morse character, but must be represented by some unique 8-bit word that can be stored in memory like any other character. The space is not generated by the scanned part of the keyboard, but is a jammed character. It is encoded by resetting the scan register (IC2) to all lows and, via gates IC11a and 11b, bits 0 and 3 are set high which in effect generates a space word. The space has its own keyboard strobe circuitry also; it is a part of IC6. (It would have been possible to generate the space character if a larger matrix for the scanned keyboard were used, but the additional logic for the jammed character was less and therefore was used.)

The Wpm Clock

The QRP keyer uses a more complicated clock than previous units. Most common wpm clocks are interconnected gates which rely on RC time constants and are predictably nonlinear. The clockwise rotation of a linear potentiometer to control speed has far too much travel on the slow end and is cramped up on the high-speed end. A log control was tried, but the improvement was not sufficient. I am sure you can remember how important it was to you when you were learning the code that your instructor be able to tell you exactly how fast he was sending. Well, to this end I put a better wpm clock in the QRP keyer.

A voltage-controlled oscillator was used for the wpm timer; this type of oscillator produces a linear scale and has nearly constant duty cycle. There is some slight shift in speed as the batteries age, but with good batteries you can say with some confidence that you know the speed to be over 10 or 15 wpm (or whatever) for a least a year.

Calibration of Wpm

The easiest way to calibrate the wpm clock is to prestore the word PARIS five times with spaces between each and time how long the keyer takes to send the set of words. After timing, apply the formula: code speed (wpm) = 300/T (sec). If, for example, the set takes 15 seconds, your code speed is 20 wpm.

Keying Relay and Sidetone

The relay circuit and the sidetone generator are derived from earlier designs, but a couple of features have been added. The sidetone is now switchable. This allows the sidetone to be silenced when the keyer is used with a transceiver which has built-in sidetone. The sidetone oscillator is turned off at its power connection to conserve power, as the audio section of the keyer draws more than the logic section.

Escape and Store Keys

The Escape key allows you to abort sending if you hear a break or if you want to change that which has already been entered into the buffer. The store function allows you to pre-type into the buffer, but not to send its contents. This is useful when you are just finishing your copy of the other station and you can pre-type in your callsigns while your contact is still sending the required identification.

Physical Layout

The keyer was built into an old but somewhat elegant box which held a tool kit for a chemical instrument. I hope you can be as lucky and find something similar. If not, a small attaché case is ideal both from a size and cost standpoint. A baseplate for the keyer was fabricated from 1/16" aluminum sheet, just big enough to fit inside the case. Photo A shows the whole unit with the cover on. As you can see, the keyboard is not enclosed. It is on spacer blocks (¾") which

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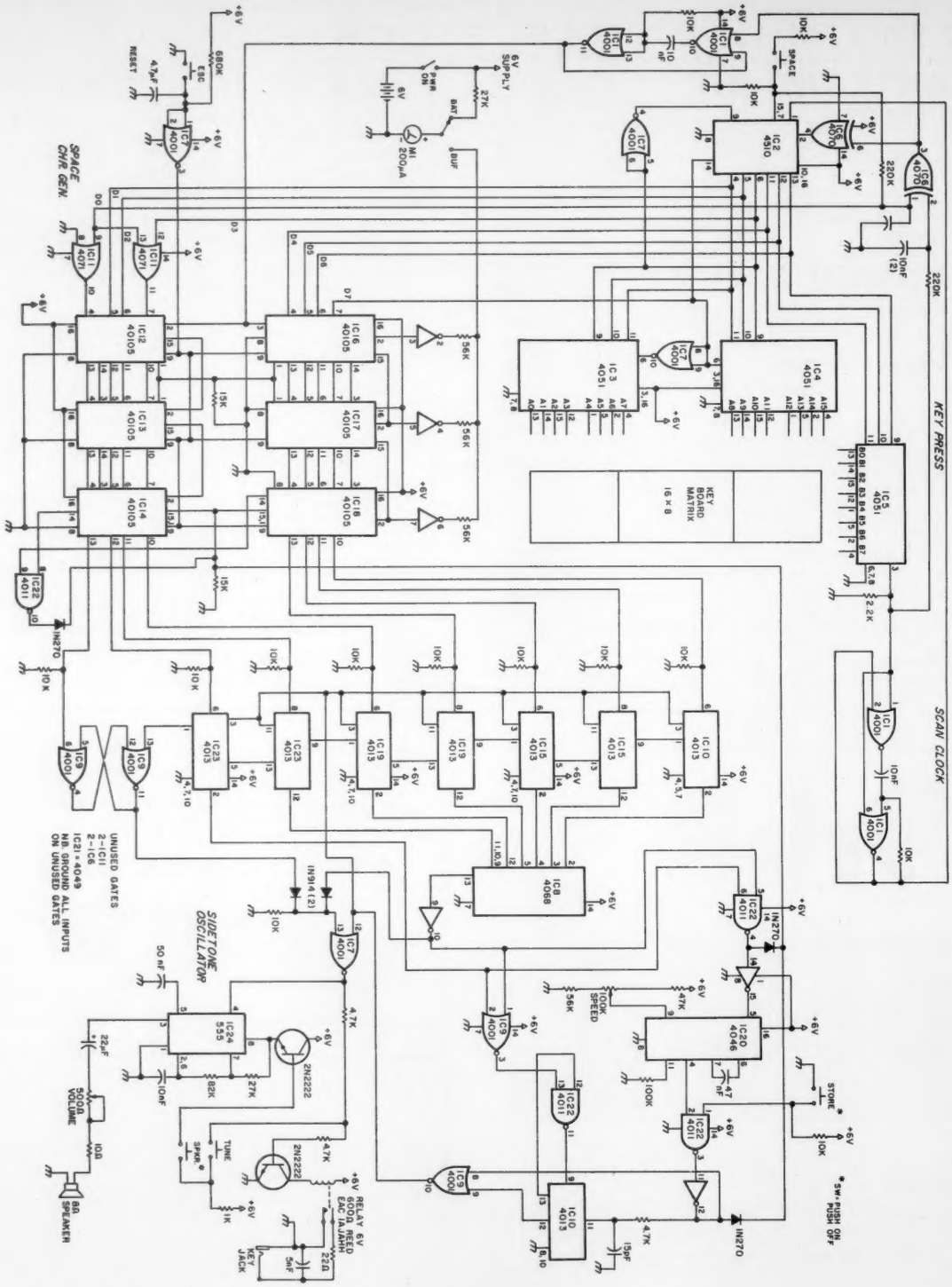

Fig. 1. QRP schematic.

provide sufficient clearance for the PC board on the bottom of the keys and its associated new wiring.

The electronics is in three parts: the main logic board — a 4½" × 6½" 44-pin computer-type card, a small perforated board for the keying relay and sidetone, and the control panel. Photo B shows the logic board and its connections to the keyboard. The small 16-conductor cable which connects together the con-

trol panel, the card, and the sidetone board is on the lower left side of the card. (See Photo C for exact placement.)

Photo C shows the control panel which has the speed control, the power switch, the battery/buffer switch, the volume control, and the miniature key jack. The panel is mounted on small standoffs which allow the speed control to clear the baseplate. As is shown in Photo A, the speed control knob is just level with the top of the panel. (In effect, the panel is in a well cut out of the cover.) Size C batteries were used as space permitted, and annual battery changes are desirable.

Photo D shows the special keytops and the Bat/Buf meter. The meter was mounted on a small plate and fitted to cover the hole for the old keyboard encoder IC which is not now used. The meter's placement is not just cosmetic, but also practical, as you can watch the meter easily while typing, as it is near the space bar.

Keytops

The keytops for the special keys are worth a few words. I have made several other keyboard controllers and was always stuck on how to label the special function keys effectively. I have tried painting the keys and using press-on lettering covered with several coats of lacquer, but this lasts only several months. On this keyer, I tried something which is much better.

The original keys were concave, and after roughing them up with fine sandpaper, a thin "float" of black epoxy was applied. With a little warming with a heat gun (or hair dryer), the epoxy conforms to the shape of a keytop, slightly convex but conforming to the top. After this was completely dry, the keys were labeled with the special functions using white press-on lettering. Next was applied a clear "float" of epoxy on the lettering. After this was set and was lightly sanded to remove any droplets or uneven areas, the tops were polished with a plastic or fine metal polish, and "professional" keytops of specific designations were the result.

As epoxy formulations vary, try the whole procedure on a small scrap of metal to ensure the compatibility of the epoxy and the lettering. I used 5-minute-type epoxy and allowed 24 hours between coats. Another possibility is to use graphite to tint the clear epoxy, but I found that the curing time for the 5-minute type extended to 48 hours due to the inhibiting action of the graphite. If you can wait, you can save some money.

Using the Keyer

When the keyer is first turned on, hit the space bar and then a letter; this initializes the logic. I usually hit an E, as this gives the fastest check that all is well when I hear the dit. If you hit the Escape key to abort sending, repeat the above procedure as this will ensure that you are loading or sending exactly what you intended.

Probably one of the most important things to remember is to send only at a speed you can receive. The temptation will be great to send faster, but just sit back and enjoy the comfort of the keyer sending while you have a sip of coffee. ■

References

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2. Steber, G., "Build a Morse-A-Keyer," parts I, II, *Popular Electronics*, January, 1981.
3. Helfrick, A. (K2BLA), "An Inexpensive Morse Keyboard," *QST*, January, 1978.
4. Lancaster, D., *CMOS Cookbook*, Sams & Co.

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Home-brew keyboard designs are now readily available and construction need be no more costly than a regular keyer. However, some home-brew designs, while effective, are limited to the basics of character generation. The operator must provide the proper timing to maintain a certain conversational speed and rhythm. This task can easily be left to the keyboard itself by the addition of a relatively inexpensive buffer memory.

The Fairchild 3341 first-in, first-out (FIFO) is a serial memory that operates in basically the same manner as a shift register. Data is entered, is shifted to the output, and is removed. However, there is an important difference between the two. The conventional shift register will retain data in its first register position until additional data enters the system and forces the previously entered data to the next register position. In the FIFO, data entering the register is immediately shifted to the first open position at the output end. This feature automatically allows buffering between two systems that operate at different data rates. The 3341 is asynchronous in that data input and output are completely independent. The 3341 can also control system speed.

Fig. 1 is a block diagram of the 3341 control logic.

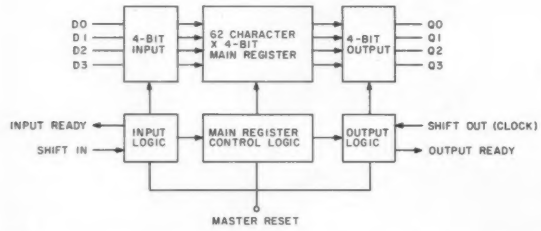

Fig. 1. The Fairchild 3341 MOS FIFO buffer block diagram.

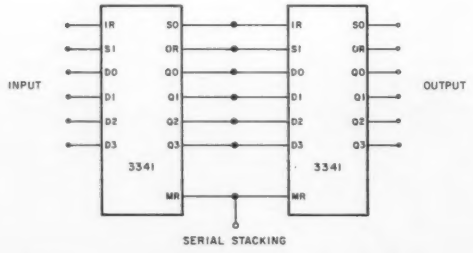

Fig. 2. FIFO serial stacking to expand a buffer memory to 128 or more characters.

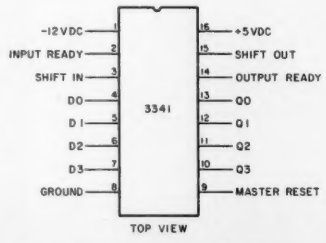

Fig. 3. 3341 connection diagram.

The main register contains sixty-two 4-bit characters, with one 4-bit character contained in each of the input and output registers, for a total of sixty-four character memory positions. Information may enter the input register on the D0 to D3 inputs when both Input Ready (IR) and Shift In (SI) logic is high. When data has entered the input register, IR goes low. Data remains in the input register a preset interval, at which time SI goes low. Data is then shifted into the main register. When the transfer is completed, IR will go high, indicating that the next entry may be accepted. If the main register is full, IR will stay low, blocking further entries. SI will now go high and the next character is accepted into the input register.

Information entering the main register is immediately shifted to the first open data position at the main register output. Transfer of a character from the main register to the output register occurs when both Output Ready (OR) and Shift Out (SO) logic is low. When the transfer has occurred, OR will go high, indicating that information is present at output pins Q0 to Q3. Transfer out of the FIFO takes place when SO logic goes high. OR logic now goes low, followed by a low on SO which again allows a character to enter the output register. SO logic can be controlled by a clock to provide an output speed control.

The 3341 FIFO may be expanded in sixty-four character steps by stacking individual chips. Fig. 2 indicates the serial stacking method. No external logic is required. If character data of more than 4 bits is required, the FIFO may also be expanded in parallel to increase capability in 4-bit steps. In this case, external logic is required to ensure that the input and output logic on each chip is ready before character transfer is attempted.

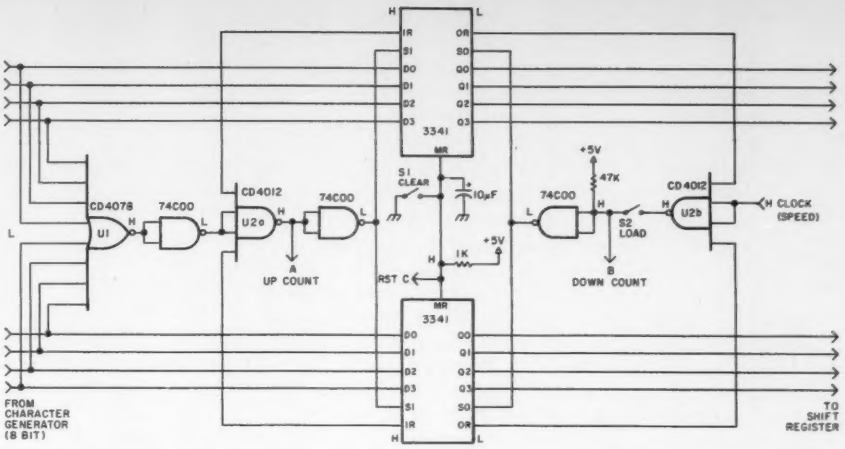

Fig. 4. FIFO parallel stacking to accommodate an 8-bit character. Logic indicated is with circuit at rest.

Refer to Fig. 3 for the 3341 connection diagram. Note that both a +5-V-dc and a −12-V-dc power source is required.

The typical home-brew keyboard probably employs either the diode matrix or the toroid transformer method of character generation. Both methods generate several parallel data pulses, the number depending on the specific CW character, which are fed into a shift register. The shift register converts the parallel data bits into serial data bits. These serial data bits form the CW character.

The FIFO is inserted between the character generator and the parallel-to-serial shift register. System speed is controlled by a clock input to the FIFO to control SO rates. A register content indicator is an option to inform the operator when the FIFO is approaching full memory status.

One keyboard design,[1] recently available as a PC board kit, is an excellent example of FIFO application to the toroid transformer method of character generation. Referring to Fig. 4, note that the character generator is 8 bits wide, requiring that two FIFO chips stacked in parallel be used. The required input logic begins with U1. A high pulse on any one of the eight character bits will cause a low U1 output. This low is inverted to a high at the input of U2A. When the IR in-

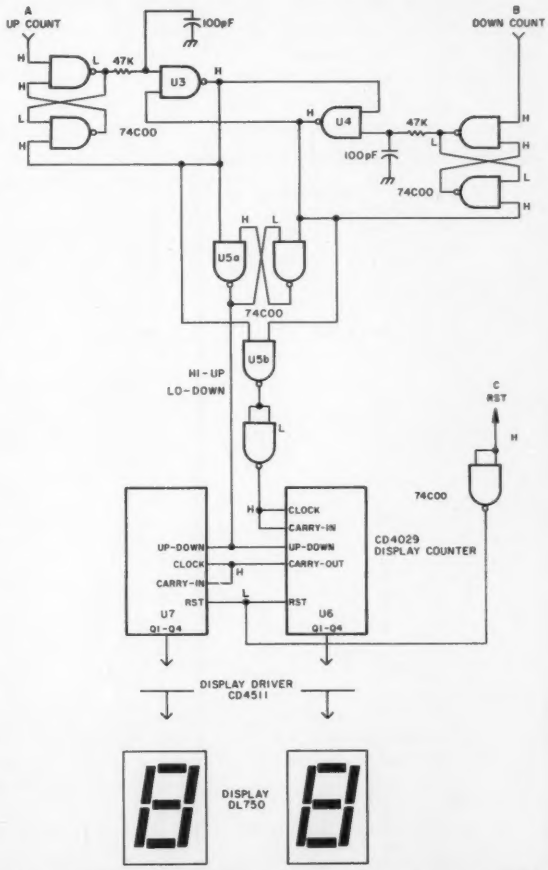

Fig. 5. FIFO register content count. Logic indicated is with circuit at rest.

puts to U2A from each FIFO are high, indicating the FIFO is ready to accept data, the output of U2A goes low. This low is inverted and appears as a high at the SI input at each FIFO, indicating that data may enter the input register. This logic ensures a coordinated flow of data into the FIFO stack.

Characters stacking up at the FIFO output are shifted out according to the speed control setting. When OR goes high on both FIFOs, indicating a character is present in the output register, a low will appear at the output of U2B. This low will occur at clock speed as long as information is flowing into the output register. If S2 is closed, the low is inverted and places a high on the SO pins of both FIFOs, and information may flow into the parallel-to-serial shift register. If S2 is open, the low cannot be inverted and the FIFO will fill to capacity. This feature allows the operator to pre-load a message into the FIFO for later transmission at the flip of a switch. The FIFO can be completely cleared by S1.

A memory content indicator, while not an absolute necessity, is certainly a worthwhile convenience. The previously mentioned design also provides an excellent example of one method of memory count logic. Referring again to Fig. 4, note that up-count, down-count, and reset inputs to the memory counter are obtained at points A, B, and C. Counter logic is displayed in Fig. 5.

U3 receives and inverts an up-count pulse from the input gating. The low output from U3 inhibits a down-count from U4 and drives the output of U5A high. A high appearing at the up/down terminal of the display counter will initiate an up-count, provided clock and carry in logic is low. The low from U3 also appears at the input to U5B, which causes the output to go high. This high is inverted and provides the necessary low at the clock and carry in terminals of the counter. This process is repeated for a down-count except that a low appears at the up/down counter input. When the count in U6 reaches its maximum count, carry out logic will go low. This low appears at the clock and carry in terminals of U7, which initiates a ten count at the next up-count command.

A buffer-equipped keyboard is truly a joy to operate. When sending at speeds below your typing ability, just fill the buffer, then sit back and compose your next sentence. The down-count will tell you when to resume typing. You can easily tell when you are approaching speeds that tax your typing ability. Just keep an eye on the memory count. If you cannot build up a lead, turn down the speed control and give the buffer room to function. Quite often your contact will sign his call after each transmission. This time can be used to fill the buffer and be set to go at first opportunity.

All logic for the example design is readily available through advertisers in this magazine. The buffer section requires one each of the 74C00, CD4012, and CD4078 logic in addition to the two FIFOs. Currently, this will cost about $15. The two each of the CD4511, CD4029, and DL750, and the three 74C00s in the counter section will cost about $10.

If you have a question on this article, an SASE will bring a prompt reply. ■

Reference

[1]*Skipjack*, AJR Electronics, PO Box 5722, Evansville, Indiana 47715.

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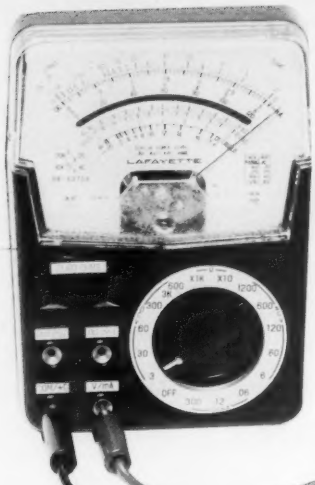

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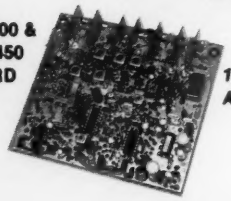

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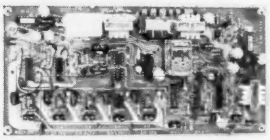

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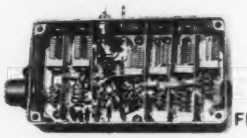

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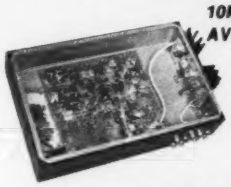

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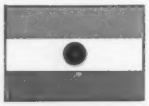
73 INTERNATIONAL

Each month, 73 brings you amateur radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Avery L. Jenkins WB8JLG.*



INDIA

The Bangalore Amateur Radio Club had its club night on Sunday, March 12, 1983. This annual function is specially held to bring ham families together. This year, the function coincided with the 70th birthday of OM Girimaji VU2GX. He was given an autographed memento by all the hams present. (See photos.)

GARDEN CITY CONTEST

This is an annual CW contest jointly organized by the Bangalore Amateur Radio Club (VU2ARC) and Visvesvaraya Industrial and Technical Museum (VU2VTM). This contest is essentially conducted to promote the DX capabilities of VU2 hams. It is held in the third week of December every year between 1200 GMT on Saturday and 1200 GMT on Sunday. The frequencies of operation used are 7 and 14 MHz.

Message Exchange: RST report with a three-digit serial number of contact (599039 = 39th contact).

Eligibility: Contest is open to all licensed amateurs worldwide.

Type of Operation: Single operator.

Classes of Entry: Group A for VU2s holding grade I license, Group B for VU2s holding grade II license. For non-VU2 hams, no group classifications.

Scoring: Points earned by VU2s for making complete contact with Asia, including India—1; Europe, Africa, and Australia—2; North and South America—3. DX stations score 1 point for every VU2 contacted.

All entries to the contest must be postmarked not later than 15th January and addressed to: The Convenor, Garden City Contest, Bangalore Amateur Radio Club, PO Box 5053, Bangalore-560 001, India.

There is no entry fee. True copy of a contest log must be submitted with sender's name, call, address, etc.

The three top scorers in each class will be awarded the winning certificates. All contestants submitting valid logs will also receive certificates of participation.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier, New Zealand

June in New Zealand is the month when the shortest day occurs (signifying the middle of the the winter season) and also the month when the New Zealand Association of Radio Transmitters (NZART) holds its Annual Conference and Convention. It is the time when the members get together to attend the Annual General Meeting and discuss the policies concerning the running of our Association. Also held are the annual meetings of the various sections of the NZART: WARO, the Women's Amateur Radio Operators, OTC, the Old-Timers Club, AREC, the Amateur Radio Emergency Corps, and forums of the VHF groups, the Novice Radio Training Scheme, and the DX buffs.

The weekend program also includes plenty of social- and radio-oriented activities—trade displays, trading tables for hams and XYLs and YLs, a dinner dance, a fox hunt on 2 meters, a mobile rally on 80 and 2 meters, and, over the past couple of years, several technical seminars and forums as well as the usual rag-chewing that always forms part of any ham get-together.

The venues of the Annual Conferences are set about two years in advance so that the branch responsible for the organization of the Conference has plenty of time for the planning of it. The Conference is held in a different city or town every year; last year it was the turn of my hometown, Napier, because it was the 50th anniversary of the formation of the Amateur Radio Emergency Corps (AREC), our emergency communication network. The AREC was born about 12 months after the devastating earthquake which hit Napier and the surrounding areas in February, 1931, when several amateur radio operators, including three within the devastated areas, maintained emergency communications for several days after the first shocks of the earthquake. As a matter of interest, some of the emergency signals were received in the United States and were the subject of an article in *QST* in 1931 or 1932.

As a result of these emergency operations, the amateurs of New Zealand saw the necessity for some form of emergency group to be available at any time to provide emergency radio communications. Since its inception, the AREC has assisted in hundreds of emergency situations including earthquakes, floods, land subsidences, aircraft crashes, mountain and bush rescues, and shipping disasters. This year's Conference was held over the first weekend in June (which is a long holiday weekend in New Zealand) at Dunedin, the main city in ZL4-land.

Next year's Conference is scheduled for Palmerston North, a university city in the center of the lower half of New Zealand's North Island. The city has some wonderful conference facilities, both in the city itself and at the university, and boasts of pleasant public gardens and recreational facilities. Overseas visitors are always welcome at our Conferences, and we have had visitors from VK, VE, W, and some of the Pacific islands in past years. So, if you are contemplating a ZL holiday, what better time to come to our fair land than at Conference time in June? If you are interested, a letter to NZART or myself will supply you with the necessary information. Even though it's winter time, a very warm welcome awaits you; the winters are reasonably mild in ZL since only the high country areas and the mountains are snow areas.

NZART NATIONAL FIELD DAY

NZART holds an annual Field Day contest each year during February, when

Photo A. (left to right) Back row: VU2IR, 3 SWLs, VU2KVR, VU2AUS, 2 SWLs, VU2RVS, VU2RRN, VU2RO, SWL, VU2GX, SWL, VU2GSM, and VU2YZ. Center row: families and VU2UV. Front row: VU2NRS, VU2USA, VU2KAX, SWL, VU2RXZ, VU2RAH, VU2VNS, and VU2VIZ.

Photo B. VU2GX presenting Pat (XYL of VU2AUS—ex-VK3KHL/NUI) a 6-kg watermelon. Others seen: VU2GSM, Mathu (SWL), VU2RAH, and VU2UV.

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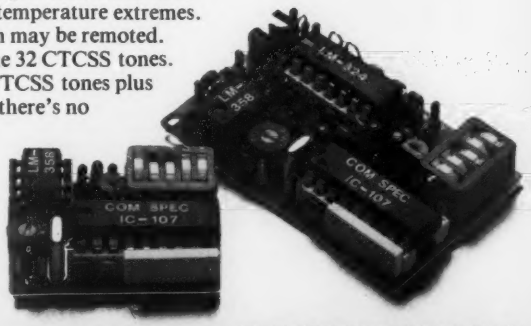

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NZART branches go portable in the field. The contest is over two days, Saturday and Sunday, the operating periods being from 1500NZST to 2400NZST, Saturday, and 0600NZST to 1500NZST, Sunday, and the frequencies used are 80 and 40 meters, CW and phone.

Field-Day stations must operate from a portable power supply, in a tent or trailer (caravan), or some other portable location, e.g., a car or mobile home, on antennas erected for the Field Day no earlier than 1200NZST on Saturday.

Our Field-Day contest this year was one of the most successful for some time. In all, over 56 branch stations operated during the two days, out of a possible 80 branches. Contacts are on phone and CW in each hourly period, with points allotted for contacts and multiplier points for the number of branches worked on each band and mode. Some overseas contacts are admissible, with stations in VK and some of the near Pacific islands only.

My local branch station was set up on the banks of the Tutekuri River, about 3 miles from the center of town. The station was set up in a tent and a mobile camper. We used tall poplars about 120 feet high for antenna supports, placing pilot lines over the top of the trees with a surf-casting rod and line. We had 80- and 40-meter dipoles at about 80 feet, a delta loop on 40 meters, and a long-wire about 500 meters long across the river as our other 80-meter antenna.

The team had 1500 contacts, for 181 multipliers, giving us a total of just over 1,000,000 points; we did not think that we were the winners, as there were two or three teams ahead of us! The station was operated from the club's portable motor generator, supplying 230 volts to the four rigs used: a Kenwood TS-930S, a Yaesu FT-101, a Yaesu FT-901, and a FTDX-401—a rig on each of the modes on the two bands used.

I hope to be able to include some of the photographs taken at Field-Day locations in a future column to illustrate the similarity between our Field-Day exercises and yours (wherever you live), as hams around the world have a lot in common concerning our hobby.

BITS 'N' PIECES

June was the diamond jubilee for one of New Zealand's original ham operators, Dan Wilkinson ZL2AB, who was allotted his callsign in June of 1923. His was the third to be granted, and he still holds the same original call today. Who knows, that could be some sort of a record. Incidentally, the first call was issued to Jack Orbell 3AA, and #2 was 4AB, the Otago Radio Society. Another early call issued in 1923 was 1AC to Len Spackman, and he, too, still holds that same callsign and is active on the Old-Timers Club Net, so his diamond jubilee will be due later this year. Dan ZL2AB is also heard regularly on the Old-Timers Net on Sunday mornings on 40 meters.

AREC PHILATELIC COVERS

A small quantity of special commemorative philatelic covers is available. Issued to commemorate the 50th anniversary of the foundation of the Amateur Radio Emergency Corps, the covers were postmarked with a special cachet in June of last year, at the time of the Annual Conference and Convention. They are unaddressed and will be sent under a separate outer cover to avoid damage.

Please send 6 IRCs for one cover by return 2nd class airmail. Send applications to Napier Branch 25, NZART, PO Box 4030, Napier, New Zealand.

DX NEWS

Chatham Islands...Allan ZL2BKM has been operating from the Chatham Islands since April and will continue until August 29, 1983, all bands, CW and phone. Allan is a radio operator in the New Zealand Post Office, and he is doing a tour of duty at the Chatham Island Coast Radio Station run by the NZ Post Office. Allan's rig is a TR-430S. When he leaves the Chathams, he will be traveling to the States with a group of New Zealand hams to attend the Seattle NEZCHEQ get-together over the US Labor Day weekend, September 2–3.

Niue Island...Peter ZL2IK has taken the position of Director of Telecommunications, Niue, a two-year tour of duty which started in mid-May. Peter is a 160 buff and will be endeavoring to work DXCC on 80 and, if it is possible, 160 during his stay in Nuie. He also will operate on the other HF bands. His rig is an IC-720; he will be ZK2IK.

Also operating from Nuie at present are two other ZL operators, Bob ZK2RS and John ZK2JS, both telecommunications technicians on tours of duty in the islands. Both of these operators are also active on the HF bands, and when these two are joined by Peter, they probably will make quite an impact on the DX front. So the DX boys will be sure of Nuie being active for some time in the future—at least until 1985 when the present ZLs' tours of duty will finish. But then let's hope more hams from ZL will take their places when they return to New Zealand.

Penrhyn Island...Warwick ZL3AFH has been active operating from Penrhyn, in the Northern Cook Islands, as ZK1WL. He will operate until some time around the middle of this year.

KOREA

J. Michael Wengert HL9KT/KH2AC
CPO Box 2961
Seoul, Korea

In the spring, a young ham's fancy turns to operating portable! Koreans are natural outdoorsmen and love to climb rocks and mountains, camp at the seashore, and generally commune with nature. A dream situation for a young Korean ham might be camping in the mountains with his favorite rig and perhaps YL. Realizing that dream, however, has been a difficult thing for Korean hams.

In the past, portable/mobile operation required permission from the MOC (Korean Ministry of Communications) in the form of a special callsign, but such operation was possible. An important restriction was that operation was not permitted in certain areas near the demilitarized zone (DMZ) that separates the hostile states of the Republic of Korea and North Korea, for obvious security reasons. Well, no matter where you go, there is a "wrong-way Charlie," and Korea is no exception. Violation of this taboo by a single ham resulted in cancellation of the privilege for all.

Efforts to regain the portable/mobile privilege are expected to come to fruition sometime this year. VHF handie-talkies are popular here but have been prohibited for use outside the shack. Most 2-meter FM operation is with Japanese mobile-type transceivers, so the changeover to mobile operation would be easy. Along with the question of permitting portable/mobile operation in Korea, the MOC is also considering issuing licenses for repeaters. In Korea's mountainous terrain, repeaters are a necessity for serious mobile work.

When portable/mobile operation is finally a reality, it will have been in no small part because of the efforts of Mr. Lee Hae Soo HL1BO, one of the pioneer hams in Korea and several-times director of the KARL. He has devoted much of his time and energies to regaining those privileges. He was instrumental in setting up the Korean National Red Cross regional club station system for use in time of national disaster and introducing the concept of amateur radio as a public service rather than a self-serving hobby. Much of this work has served to convince the Korean authorities of the value of amateur radio to society and encouraged them to liberalize the rules and regulations applying to amateur operation. A *73* International salute to HL1BO!

Much confusion regarding QSL Bureaus took place when the Korean hams changed over from HM to HL prefixes as a result of the 1973 WARC. Until that time, only US Forces/United Nations Command personnel used the HL prefix. To further complicate things, at about the same time, the USFK/UNC QSL address changed.

Following is the *correct* information: HL9 stations—American Amateur Radio Club of Korea, c/o Dependent Mail Section, APO San Francisco CA 96301; all other HL stations (1,2,3,4,5,8,0)—Korean Amateur Radio League, CPO Box 162, Seoul, Korea.

One final note...when signing with a Korean station, if you really want that QSL card, *never say Sayonara*! Koreans are completely different people from the Japanese. The correct farewell would be *Ahn-young!*

Well then, Ahn-young and 73 from the Land of the Morning Calm.

CANADA

(Reprinted from the CARF News Service Radio News *No. 7/83 by permission of the Canadian Amateur Radio Federation, Inc.)*

As the old saying goes, you win some, you lose some, and here's some proof. The same Privy Council Office which held up proposed license increases so long that they could not be implemented this year has been sitting on proposed revisions to the amateur regs since last May. The proposed changes which surfaced a couple of weeks ago were some of those which resulted from recommendations made to DOC (Department of Communications) by amateurs at the 1981 CARF Symposium. Included were revisions which would lift power restrictions on 160 meters, permit repeaters on 10 meters, allow European amateurs to use all of the two-meter band while operating in Canada under a reciprocal operating agreement, and redefine permitted bandwidths for AM, FM, FSK, and ATV. DOC hopes that now that these drafts which it had submitted to the Privy Council have been found, they will be approved fairly soon.

British Columbia amateurs were involved in a novel way in the recent Royal Tour activities in Vancouver. During the ceremonies connected with the upcoming 1984 World Exposition, held in the new BC Place, the Queen's speech on March 9 was relayed by a 450-MHz link to Vancouver repeater VE7RPT and retransmitted on 20 and 40 meters. To mark the event, BC amateurs were allowed to use the prefix XO. A special QSL card is available to listeners who report hearing the broadcast. VE7 stations who used the XO prefix can obtain a special QSL card free from the BC government.

TOWERS COLLAPSE

The worst ice storm in Manitoba's history hit in early March and put Brandon and Baldy Mountain repeaters out of business when the broadcast towers holding their antennas collapsed. Many amateurs lost their antennas and some had the tough luck to lose their towers as well, according to VE4MG.

CORDLESS TELEPHONES

The cordless telephone, like CB radio, is rapidly becoming a fad, and like CB radio, it already poses problems for amateurs. QRM from these devices is already showing up from their harmonics in the 40- and 80-meter bands and some of them are, according to a US source, being crystalled in the 160-meter band. DOC is currently working on some regulations concerning them. Just to complicate the scene, there is apparently a 25-Watt amplifier now on the market. The phones themselves operate duplex, using 49 meters and 1.6 to 1.8 MHz, although the latter slot is going to the broadcast-band expansion in a couple of years. These things work well, but the Consumers' Association of Canada points out that with some models which have dial-out facilities, it is possible to access another telephone line and rack up toll-line charges on it.

BRAZIL

Carlos Vianna Carneiro PY1CC
Rua Afonso Pena 49, Apt. 701
20270 Rio de Janeiro, RJ
Brazil

YL FROM BRAZIL

Need a "sure QSL" from Brazil? Looking for a YL contact for your YL award? Well, all you have to do is come to 14.248 kHz every Wednesday from 1900 to 2100 UTC and join the BRYLA (Brazilian YL) net. The net has existed since March, 1976, and is directed by Inge PY2JY. The net attracts YLs from all of the Brazilian states on both SSB and CW.

Inge has held her license only since 1970, but she fell so in love with amateur radio that she now has 290 countries and holds this BRYLA net to stimulate DX operations with Brazilian YLs and to spread the BRYLA Award to all places and continents. 159 of these awards have been sent to 35 countries of the 105 countries filed by the net.

Listen to PY1YL, PY1AIP, PY1LMS, PY1MF, PY1DVQ, PT2ML, PT2SV, PT2LS, PT2TF, PT2DCR, PY2ATL, PY2DLZ, PY2FL, PY2JY, PY4AKL, PY4ML, PY4DY, PY4RA, PY2ACR, PY5BZN, PY7AVN, PY7VBG, PY8SSB/7, PS8YL, and many others on the BRYLA net, and most of the requirements for the BRYLA Award will be fulfilled.

The BRYLA Award was created by Therezinha PT2TF, and it is great! DX stations must prove a two-way QSO with 12 YLs from different countries on three continents, plus 8 YL stations from Brazil—on any band, any mode, and all QSOs from 1975 on are valid.

The log must be certified by a radio association and must include the station, date, time, mode, report, and band. SWLs also may qualify. Send QSLs for files and

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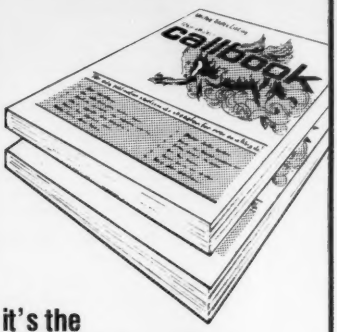

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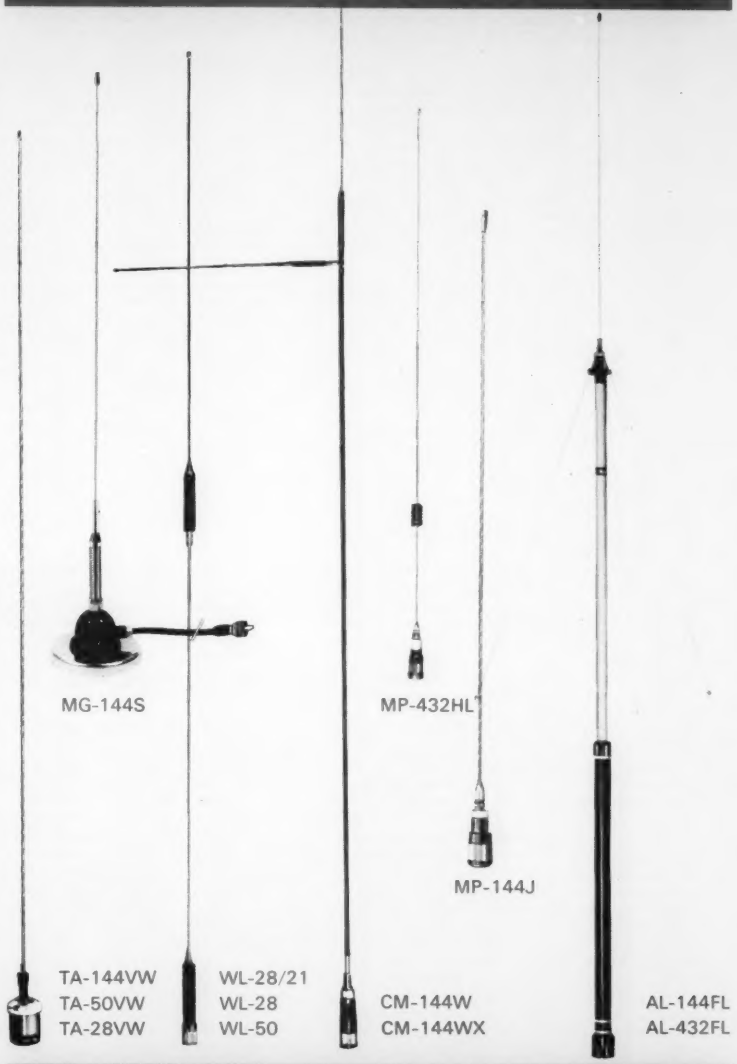

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10 IRCs to BRYLA, c/o Ziza PT2LS, PO Box 07/0004, 70000 Brasilia, DF, Brazil, South America.

On the BRYLA net, you can find Eva PY2PE, DXCC Honor Roll member, Tessy PS8YL and Marilia PY4AKL, who both have more than 300 countries, Inge PY2JY with 290 countries, and PY2ADI with 172 countries. Ziza is BRYLA Award Manager with hundreds of first-class awards including 5 BRYLA Awards which were endorsed all CW.

When propagation is fine, Japan, Hawaii, New Zealand, Australia, and many other first-class DX stations are available.

A general CQ is called aiming the beam to South Africa, Asia, or Europe, and traffic is passed just like other international nets. Each YL is listed and one by one they QSO the other participants. No "chats" are allowed during these two hours so all calls can be answered. Only a call and report will be given by each YL.

Another very funny award was created by Inge, the WBYL (Worked Brazilian YL) Award, and it has been offered since the first day of 1981, with the first request coming from South Africa. Just contact 8 Brazilian YL stations and form the words "BRASIL YL" using any one letter from each suffix. One of the YL stations must be a PY2. Any band, any mode. The standard log is required, including station worked, date, time, mode, report, and band. SWL entries are also accepted. Send QSLs with 10 IRCs for return postage to Inge Tobias de Aguiar PY2JY, Rua Texas 448, 04557 Brooklin Novo, Sao Paulo, Brazil, South America.

Inge is so enthusiastic for radio, she was the first YL to operate VHF from a hot-air balloon flying over Sao Paulo, on August 18, 1974. She was with her husband Jose PY2JO and Vitorio Truffi, balloonist and proprietor.

She also participated in two DXpeditions to Arvoredo Island in 1975 and 1980. This island is the most beautiful small island in the world and is located at 46° 10' W and 23° 58' S, 176 miles from Rio de Janeiro. It was developed and maintained by Fernando Edward Lee.

There are hundreds of birds and fishes which come from distant places to the island. The island also has the largest wind alternator in the world, a lighthouse, solar water heating, a rainwater reservoir with a 1-million-liter capacity, and coconut trees which give 12,000 liters of coconut milk each year. There is also a 70-ton crane which can easily lift a 3-ton yacht into a specially-designed tank. Paradise on Earth, says Inge.

A new net is being planned and studied for 14288 kHz on Wednesdays at 2330 UTC. It will be beaming toward the USA and Canada.

LIBERIA

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Liberia is on the westernmost point of the great continent of Africa. Most of the country is nearly at sea level, although there are parts of the interior that rise to somewhat over a thousand feet. For whatever reason, the amateurs in this country enjoy excellent communications conditions with the United States, all of Europe, and in the direction of Russia during the greater part of the year. It seems to be well situated geographically and it is in the GMT time zone.

The amateurs in the country number less than a hundred and most are not natives. The reason for this situation is simply that Africans have had little opportunity to learn amateur radio and, for the most part, they do not have the money to purchase and operate radio equipment. Very few of the cities have electrical power and those that do have it for only a part of the day.

The Liberian Amateur Radio Association (LARA), under the direction of Mr. Benjamin Walcott, is doing everything in its power to reverse those statistics. Radio classes are being run in increasing numbers and the response is very gratifying. In Monrovia, a course is being taught currently at St. Patrick High School, and the turnout is over a hundred persons of all ages and includes both men and women. These classes operate under great difficulty since textbooks are not available and things like code oscillators are rare. The students must rely on class notes and on duplicated pages which are prepared and handed out by the instructor. Many of the people have tape recorders, which are a great help.

When the students are licensed, there is the problem of equipment for them to use. The association plans to gradually set up club stations in strategic areas so that those who do not have their own equipment may have access to a club station. At the present time, there is one such club station in operation. The equipment for these club stations will have to come from amateur friends in other parts of the world. The station which is presently operational was donated by a radio club in Barberton, Ohio.

The Telecommunications Ministry here in Monrovia has neither the personnel nor the funds to test and evaluate applicants for amateur licenses. The government relies on the LARA to do this job for them. The LARA instructs persons interested in amateur radio, tests them, and when they have met the requirements, recommends them to the Ministry for licensing. This system is working remarkably well and the cost to the government is minimal.

Amateur radio in Liberia is proud of its record of performance in times of emergency and disaster. It measures up to the high standards of amateur radio around the world, and it is the aim of the LARA to expand the numbers of operators, increase amateur activity, and at the same time maintain the high standards at which it now functions.

(Brother Donard is Secretary of the Liberian Amateur Radio Association.—Ed.)

GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire, England

The continuing growth of interest in amateur radio in the United Kingdom was evidenced recently when the Radio Society of Great Britain (RSGB) held a National Amateur Radio Convention at the National Exhibition Center near Birmingham. The NEC is a prestige exhibition and conference center with its own airport, railway station, and hotel complex situated more or less in the center of England and well served by motorways (freeways).

I had previously visited NEC for trade shows such as Communications 83 and the International Business Show and had found parking easy and queues minimal. Not so with the RSGB, who, although using a hall of adequate size, had arranged for only two ticket counters to be open. This meant a wait of some twenty minutes in a fresh breeze which at least sharpened our minds for the coming fray.

The majority of major importers were exhibiting the latest in Japanese microprocessor-controlled black boxes. I tried, unsuccessfully, to find a new rig that performed better than my FT-101 rather than just outdid it in numbers of knobs. There are no longer any indigenous manufacturers of HF gear in the UK. However, we do have some able representatives in the specialist scene including Microwave Modules and Wood & Douglas. MM displayed its range of transverters for 2 meters and 70 centimeters, together with linear amplifiers for these and higher bands. Perhaps their most innovative product (and one that always attracts attention) is the Morse Talker. This microprocessor-controlled device sends random Morse at a user-selected rate and then speaks the letters sent for the pupil to check his copying. As an option, the model two will interpret (but not comment upon!) pupil-sent Morse.

Wood & Douglas exhibited a range of 70 cm, 2-, 4-, and 6-meter kits, and modules for the construction-minded operator. As well as traders, the exhibition hall included the various support groups such as the RSGB (showing its extensive range of books), AMSAT-UK, selling the newly-published *Technical Handbook*, Navy and Air Force Amateur Radio Societies, the Radio Amateur Invalid and Bedfast Club, and BARTG (the British Amateur Radio Teleprinter Group).

With most of the stands 5 deep in excited people clutching for leaflets, it was something of a relief to take a break for lunch. This is an area in which we have a little to learn from the US. The choice at NEC was to queue for half an hour for a very soggy beefburger or (as we did) walk over to the attached Metropole Hotel and pay over the odds for an average meal.

Many believe that the intense interest in amateur radio is a spin-off from the recently legalized CB service (27 MHz, FM, 4 Watts) which many are finding frustrating and uninteresting (surprise, surprise!). Lots of ex-CBers are furiously studying for the radio amateurs' examination, which twice yearly opens the doors to those answering the questions correctly.

Some early problems with CBers spreading into the 10m band have now largely disappeared. My own local cowboy was discouraged from using 28.1 for SSB by some 200-Watt RTTY tests I ran! There is, however, some worry over here about the 10m band and its lack of use during quiet sunspot periods. Moves are afoot to encourage FM around 29.6 for mobile-to-mobile working (many 2m repeaters are very busy indeed).

Cheap CB rigs ($25.00 to $50.00) are being snapped up and converted from 27 to 29 MHz quite easily. Although low in price, some of these are from well-known names such as Icom and offer a range of facilities including 40 channels.

The RSGB is encouraging 10m usage by promoting a new 28-MHz Counties Award. This requires confirmed contacts on 10m (any mode) with 40 UK counties/Scottish regions from the total of 77. Contacts must be made after April 1, 1983. The award is free to RSGB members and $3.00 to others.

FRANCE

Claude Guee F1DGY
11 Rue Emile Labiche
28100 Dreux, France

2M FM REPEATERS

About 25 FM repeaters are located in France. Placed on 15 channels in 25-kHz steps, they can be found between 144.725 and 145.175 MHz, with a + 600-kHz offset. ERP is between 20 W and 200 W. Some are very busy.

70-CM FM REPEATERS

France has about 10 of these repeaters. Present channels of the machines will be moved, but all have a – 1600-MHz offset.

AWARD: DIPLOME VILLE DE PARIS

HF bands: Class 1—contact 20 arrondissements, Class 2—contact 15 arrondissements, Class 3—contact 10 arrondissements. All contacts after January 1, 1946. A log book certified by an officer of the national organization is required. Fee: 30 FF (IRC).

For YL: 10 arrondissements, or 20 for "diplome d'honneur."

Diplome manager: Bernard Louis F5BL, 15 Place d'Aligre, 75012 Paris, France.

WORLD COMMUNICATIONS YEAR

For this event, French stations are authorized to use a TO prefix.

SATELLITE ACTIVITY

RACE (Radio Amateur Club de l'Espace) is supporting ARSENE (Ariane Radio Amateur Satellite Enseignement Espace). This satellite is scheduled to be launched by Ariane IV by the end of 1985. Two modes are planned: B and F (2.4 GHz and 435 MHz). The orbit will be an equatorial ellipse. The president of RACE is F8ZS and the vice president is F8YY.

SWITZERLAND

Peter W. Frey HB9MQM
PO Box 1127
CH-5401 Baden
Switzerland

As in most other Western countries, repeaters are an important aspect of amateur radio in Switzerland. However, in the last couple of years, many amateurs in this country have grown increasingly skeptical about what some call "garbage-in-garbage-out machines." They charge, for example—not entirely unfounded—that repeaters tend to promote bad operating practices and that the difference between what you hear on 27 MHz and on 145 MHz has become rather marginal. Monitoring a 2-meter repeater like HB9AN near Zurich, the biggest Swiss city, for a day can indeed be a frustrating experience: QSOs abound with CB-type lingo and their content is only too often in violation of the rules. (Remember, for example, that third-party traffic of any kind is an absolute no-no in almost all of Europe!)

So far, repeater jammers in Switzerland haven't had to fear much in terms of getting caught. Some repeaters, like HB9F on top of Mount Schilthorn (known to James Bond 007 movie addicts as "Piz Gloria") in

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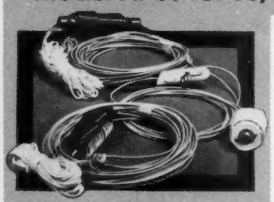

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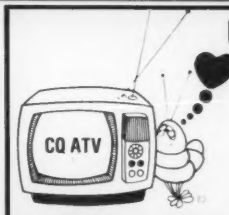

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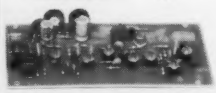

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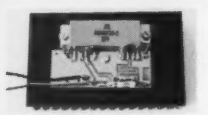

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the Bernese Oberland or HB9RW on top of the Parpaner Rothorn in the southeastern part of the country, are situated well above 9000 feet. They cover a great part of Switzerland and considerable portions of neighboring countries, thus making it a rather difficult task to locate and track down a jammer. On top of that, the radio surveillance people of the Swiss PTT can't provide as much help as the amateurs sometimes expect. They are facing enough problems already in coping with the messy 27-MHz situation in this country.

For the officials of the Swiss national society, repeaters are a constant item on the agenda. It's the business of repeater coordinating that sometimes gives them headaches. If you thought repeater coordinating was difficult in the US, imagine just how it is to coordinate repeater frequencies when societies and authorities of some five countries are involved!

The 2-meter band plan of the International Amateur Radio Union Region 1 (Europe, the Soviet Union, and Africa) provides only for ten repeater channels designated R0 to R9 with inputs located between 145.000 MHz and 145.225 MHz and outputs 600 kHz higher. You don't need to be a repeater-coverage expert to see that it is close to impossible to cater to all wishes with only ten channels available. Therefore, repeater problems are an everyday fare for the VHF managers of Europe's national societies.

A few years ago, one could even witness a "repeater war" in Central Europe. The French national society unilaterally decided to put into operation a couple of repeaters on frequency pairs well apart from the internationally-agreed-on channels and with inputs right in the middle of the 2-meter-beacon band. The Austrians closely followed suit. Through a lot of negotiating across country borders and shuffling around of channels, the problem is now in the process of being resolved. However, when you're experimenting with HB9W, the flea-power (36 mW!) S-meter calibrating beacon on Zurich's Mount Uto, you still stand a good chance that your test is rendered useless because of constant interference. The input of an Austrian repeater on Mount Valluga just across the border is on exactly the same frequency.

DENMARK

Hanne Nielsen OZ1CID
Hvidovrevej 468
2650 Hvidovre
Denmark

In Denmark we are 8000 radio amateurs strong, and about 7000 are members of EDR (Experimenterende Danske Radioamatører). Under EDR we have 60 local divisions of varying size.

The Copenhagen Division, or as we call it, club, is the biggest, with 300 members. We have our own house bought in 1974. The club was founded in 1932 and we have just celebrated our 50th jubilee.

During the week, we have many activities. Monday evenings we have a common meeting with lectures upon different technical sides of our hobby and afterwards comfortable talks over a cup of coffee and some eatables. Of course, the club station is on the air with the call OZ5EDR.

The EDR Copenhagen Division QTH.

Tuesday we have laboratory evening, where members can receive technical assistance for their problems with stations or construction projects or, as a group, we start some new projects. Four to five days every week, except in the summer time, we have technical courses and CW courses for those who want to have a license or upgrade their present license.

In the clubhouse, we have a laboratory, library, VHF/UHF shack, HF shack, instruction room, office, dining room, three apartments for leasing to members, a workshop, material rooms, and a newly established museum for radio amateurs. Outside the house, we have an antenna mast with HF/VHF/UHF beams.

Many weekends we join into the different national and international contests on both CW and SSB. Joining in Field Days and the Jamboree on the Air are also some of our activities. We also do a lot in award hunting. That special side of our hobby hasn't been going on for more than 4 years, but through many QSOs and a fine award manager, we now have got 104 different awards decorating our walls, many from *73* magazine. We have also founded 2 awards: The Copenhagen Award founded many years ago, and the OZ Prefix Award founded on the occasion of the 1982 jubilee.

The house we own is very old. Every weekend some members work on it as there is always something to do and we are not able to pay workers from outside.

It's very nice, as a chairman, to see that our hobby, amateur radio, is flowering, not only in the Copenhagen Division of EDR, but everywhere. If any radio amateur in the USA should visit Copenhagen, you would be very welcome to visit our club.

SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S-155 00 Nykvarn
Sweden

SCANDINAVIAN HORIZON

"Do you always carry your radio with you whenever you travel?" the customs lady asked me at Logan Airport in Boston, Massachusetts, when I unloaded the two 40-pound boxes with ham gear in addition to our 5-person family luggage. "Yes, I always do," I replied, and she let us pass through.

Most of us hams like to have our radios with us when we travel. It sure is fun to experience how the bands sound at a distant location from home. A 2-meter FM handheld can give you lots of opportunities to meet local hams during a vacation in a foreign country. Many of you Americans have been fortunate enough to be able to use ham radio far away from home while in the service overseas. However, only some twenty years ago or less, a citizenship in the licensing country was required. Luckily, this has changed in recent years. Many countries now have formal reciprocal agreements for temporary licenses for foreign visitors.

A DREAM COMES TRUE

You are planning your trip to some foreign country and you would like to operate ham radio while staying there. Start your planning well in advance. If you have no information on licensing in the country concerned, write to their telecommunications authority or the amateur radio organization in that country for information. Addresses can be found in ham magazines and in the *Callbook*. The easiest way, though, is to write to your own national amateur radio organization for reciprocal licensing information.

Generally speaking, the following things are common in most European countries:

- A reciprocal licensing agreement between the two countries
- Application required
- Processing time, one to three months
- License issued for a period of maximum three months each calendar year
- Operating privileges in accordance with the class of license in the country you visit which is closest to your own license
- You have to follow the regulations in the country you visit which can differ a lot from what you are used to back home, especially maximum power limits and frequencies used

There are some important differences from country to country. The following is currently valid for each of the Scandinavian (Nordic) countries.

Denmark. An application with the following data should be sent to Radiotekniske Tjenste, Tilladelsessektionen, Islands Brygge 83 C, DK-2300 Kobenhavn S, Denmark: Name and address of applicant, date of birth and town, citizenship, callsign and class of license, time period for the stay in Denmark, address in Denmark, any remarks, and date and signature.

A photocopy of your license, certified by two persons, should be attached to your application. This procedure is accepted for applicants from the USA, Canada, Brazil, Australia, Portugal, Switzerland, France, Spain, Luxembourg, Belgium, West Germany, Great Britain, Holland, Iceland, Sweden, Norway, and Finland. Amateurs from other countries have to supply documents stating the requirements for a ham license in their country in addition to the license document.

The fee, 20 Danish kroner (around $2.50), shall be paid when arriving in Denmark. A special money order form sent with the license should be used. The same procedure applies for the Faroe Islands, prefix OY.

Finland. The Finnish amateur radio organization, SRAL, has a somewhat different status than what is common in other countries. It is mandatory to be a member of the SRAL when being a ham in Finland. Your application sent to the SRAL will be handled faster than if sent directly to the licensing authority. The address is Suomen Radioamatooriliitto r.y., Postilokero 306, SF-00101 Helsinki 10, Finland.

The application shall state your complete name and address, citizenship, fixed station address in Finland, time period for the stay in Finland, any remarks, and date and signature.

A photocopy of your license and personal identification (photocopy of passport or similar document) is required. Finland requires reciprocal agreements. Non-Finnish citizens are prohibited from working mobile ham radio.

The fee is 38 Finnish Markka (around $8.50) and the license is sent COD.

Norway. Norway also requires a reciprocal agreement, and application shall be mailed to Norwegian Telecommunications Administration, Radio Inspection Office, PO Box 6701 St. Olavs Plass, N-Oslo 1, Norway.

Preferably, you should send for their ap-

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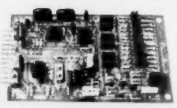

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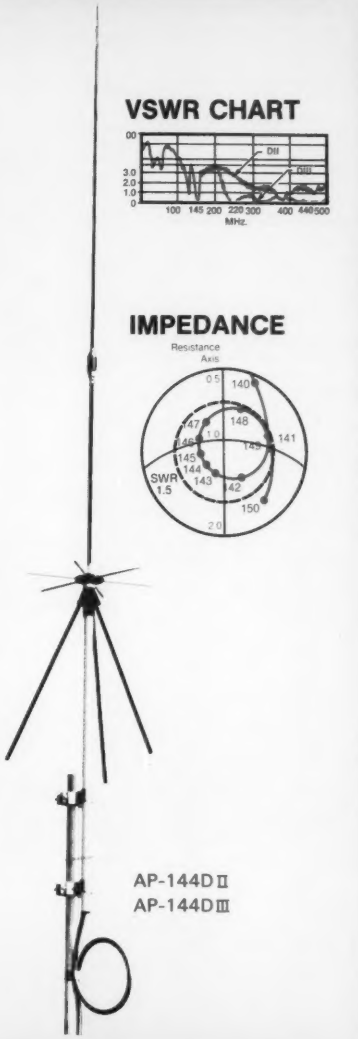

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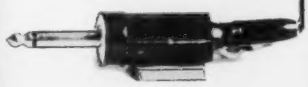

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plication form which includes about the same data to be filled out as for the other countries. If you intend to operate mobile, the registration number of your vehicle shall be stated. If you intend to rent a car, you can state that. One important difference is that you have to enclose a Certificate of Good Conduct issued by your local police authority.

If you are a foreign citizen but a resident in Norway, you can apply for a license one year at a time. The prefix then is LA0. Operations from the Norwegian territories JW0, JX0, and 3Y0 are under separate regulations.

The fee is 50 Norwegian kroner (around $8.00), and shall be included with the application.

Sweden. Together with Denmark, Sweden is one of a few countries that does not require reciprocal agreements. We have agreements, however, due to the reason that otherwise we would not be able to operate in countries where they require such formal agreements. The application form includes the regular data and shall be sent to The Swedish Telecommunications Radio Department, Licensing Section, S-123 86 Farsta, Sweden. The application can be written in Swedish, Danish, Norwegian, English, French, or German. A copy of your valid license and a Certificate of Good Conduct (impunity) issued by the police authorities in your native country must be included. In certain countries, such a certificate cannot be obtained. A certificate issued by the applicant's amateur radio organization must then be included.

The fee is 80 Swedish kroner (around $13.50), and shall be sent after you have received your temporary permit. They prefer not to receive payments in advance.

Any foreign national with permanent residence in Sweden for a considerable time (currently 3 years) can get a permanent Swedish license. If holding a foreign license, the equivalent Swedish license will be issued without any further exams. However, one obstacle to getting the highest class of license, class A, is the code proficiency requirements. Most countries have 12 wpm as their highest code speed. A code exam at 16 wpm will solve that problem.

In both Finland and Sweden, you use your call followed by /OH or /SM and a number stating the district where the radio transmitter is used temporarily.

LG5LG and SJ9WL. These two callsigns belong to the same station located on the border of Norway and Sweden, not very far from Oslo, the capital city of Norway. The place is called Morokulien, a name combined of the word "fun" in those two languages. It is not a separate DXCC country, but you can operate this amateur station without any reciprocal agreements. The only requirement is that you show your valid ham license when visiting the station. You can rent the house with the station if you would like to spend a few vacation days there. However, if you want to rent, you are advised to make reservations.

COMPARISON WITH THE US

As a comparison, the reciprocal licensing for visiting hams in the US is very favorable. There is no fee, the license is issued for up to one year at a time and is renewable, and the processing time is short (usually sent by return mail), although the application form states 60 days. However, if your country does not have a reciprocal license agreement with the US and you want to operate from there, you can take the exams at an FCC (Federal Communications Commission) office. US citizenship is not required, and you can go through all exams at the same time if agreed upon by the local FCC office. You start with (e.g.) the 20-wpm code and then take the combined Technician/General class 70-question exam. If you pass, you can continue with the Advanced written exam and finish with the Extra. Then you just wait for the mail.

CONCLUSION

If you plan to visit a foreign country, apply for a license and you get a chance to meet the people. That is much more rewarding than all the tourist attractions in the world.

WEST GERMANY

Hans J. Schalk DJ8BT
Hammarskjold-Ring 174
D 6000 Frankfurt 50
West Germany

FROM AMSAT/DL

The ESA (European Space Agency) fixed—as of this writing—the launching date for the ARIANE flight as June 3, 1983. Expected for this flight was the carrying of the European communication satellite ECS 1 as well as the AMSAT Phase-IIIB satellite. Further ARIANE starts are scheduled for August and November, 1983, as well as January, 1984.

See box for contest results.

ANTARCTIC EXPEDITION

Presently on a visit to the Antarctic is Loy Y44YK. He is scheduled to be QRV as Y83ANT in the near future. His equipment: two transceivers with 150-W input, Type

RESULTS OF THE 15TH EUROPEAN DX CONTEST WAEDC 1982 RTTY

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5. SM6ASD	243	441	184	125856
6. W3FV	196	324	209	108680
7. IC8POF	229	417	152	98192
8. OH1IJ	248	418	147	97902
9. DJ2YA	160	386	172	93912
10. 4Z4KB	176	150	191	62266
11. I8JRA	139	280	124	51956
12. KB2VO	173	109	131	36942
13. YO3AC	123	265	94	36472
14. OE2SNL	123	174	117	34749
15. DJ6QT/CT3	106	89	171	33345
16. Y79XN	143	254	78	30966
17. 4N7NS	111	230	76	25916
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19. ON7KK	154	0	154	23716
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24. DL8QP	73	168	69	16629
25. EA1AEB	154	0	101	15554
26. DJ9IR	79	152	54	12474
27. DJ1XT	78	136	56	11984
28. EA8ZZ	73	84	75	11775
29. K1LPS	73	27	94	9400
30. KJ2N	67	88	60	9300
31. OK2BJT	74	127	46	9246
32. DF1LX	61	113	52	9048
33. OK2SPS	83	147	35	8050
34. K6WZ	60	54	65	7410
35. DF6AI	66	98	41	6724
36. DJ2YE	90	0	70	6300
37. DF6ZY	52	123	35	6125
38. F6DBY	71	0	82	5822
39. Y23VB	76	50	46	5796
40. KP4BJD	66	0	77	5082
41. EA5CVR	73	0	67	4891
42. SM6BUV	51	77	34	4352
43. WB4UBD	34	53	46	4002
44. EA9JZ	67	0	57	3819
45. W3AOH	75	0	50	3750
46. LU3DSU	51	0	73	3723
47. EA7BBK	74	0	42	3108
48. SM5BRG	40	101	18	2538
49. EA3DMP	49	0	45	2205
50. DL8CX	44	0	46	2024
51. VK2BQS	20	41	30	1830
52. DK5KJ	30	25	26	1430
53. Y33UO	37	11	28	1344
54. YO8FR	48	0	27	1296
55. Y22UL	22	40	18	1116
56. Y33TA	21	39	13	780
57. DK4IS	23	0	12	276
58. VK8BE	13	0	20	260
59. YJ8TT	13	0	18	234
60. JA7KM	4	0	8	32

Multi-Operator

1. LZ1KDP	367	742	196	217364
2. I2DMI	329	576	209	189145
3. OH2AA	327	519	188	159048
4. G3UUP	272	497	188	144572
5. HG5A	257	508	178	136170
6. OH8TA	274	428	160	112320
7. EB1BM	310	10	310	99200
8. YO3KPA	209	306	108	55620
9. UK4LAM	136	169	58	17690
10. YO5KLK	157	0	79	12403
11. DK0OW	49	86	50	6750
12. OK3RJB	79	25	63	6552
13. JA2YKA	34	20	44	2376
14. JA6YDH	05	10	02	30

SWL

Name		QSO	QTC	Multi	Score
1. Stig Kahr	(OZ)	302	469	180	138780
2. Alexander I. Yurchenko	(UB5)	283	440	165	119295
3. Hans Waterstraat	(Y2)	207	226	189	81837
4. Werner Ludwig	(DL)	209	236	174	77430
5. Vaclav Cesak	(OK)	166	148	143	44902
6. Frans van Oostenbrugge	(PA)	111	86	79	15563
7. Jaromir Marisler	(OK)	140	47	71	13277
8. Jindrich Bozek	(OK)	82	76	19	3002
9. V. I. Yermolenko	(UC2)	35	41	24	1824

Trophy winners, Single Operator—Y39XO (Europe), W3FV (North America), 4Z4KB (Asia), DJ6QT/CT3 (Africa), HC5EA (South America), and VK2BQS (Oceania); Multi-operator—LZ1KDP (Europe), and JA2YKA (Asia); SWL—Stig Kahr (Europe).

Checklogs: DE1KWD, DE4TTY, DL1VR, OK3JKF, K8CV, PE1HQR, Y43WK, Y55ZF, YU7AM, and SWL-W8 John Mathews. Contest manager: DF7FB, tnx to D E 8 B U S .

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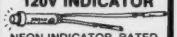

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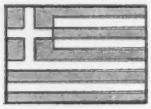
"Teltow 215." For antennas—dipoles and fixed quads.

The club station of the West German South Pole expedition (DP0AA) is presently not QRV owing to illness of the operator, DF3LK.



GREECE

Anastasios D. Panos SV1IG
4 Voltairou St., N. Kosmos
Athens 411
Greece

The Ministry of Communications, which is responsible for issuing licenses for new amateurs, announced that 43 hobbyists passed the tests in March. Exams are held twice a year in Athens, during March and September. Negotiations between radio amateur officials of the Radio Amateur Association of Greece (RAAG) and the Ministry of Communications are being made so that at least once a year exams are held in northern Greece (Thessaloniki). Newcomers to the hobby are issued a C class ticket which allows them to operate with 50 Watts on the HF and 5 Watts on the VHF bands, and this is the only limitation. They are free to operate any frequency in all bands and in any mode.

Elections for RAAG's new board of directors were held in February with about 1000 members, but only the 360 licensed members have the right to vote. The new board of directors is as follows: Evangelos Moustakas SV1AN, president; Kostas Fimerelis SV1DH, vice president; Kostas Thanopoulos SV1DC, secretary; Manolis Darkadakis SV1IW, treasurer; Dimitrios Konstantinou SV1GL, member; and Dimitrios Alexandris SV1LL, member.

Elections are held once every two years and candidates for the board of directors must be licensed members for at least 5 years. Members with the right to vote must be licensed and have at least one year in the association.

After a long waiting time, the new repeater R3 (145.075 in, 145.675 out) was placed at Heraklion, Crete Island. There are some problems with the antenna system, but these will be solved soon. Similar problems, plus interference in the input of the R2 repeater in Athens forced it out of operation, and it is in the fine hands of Dimitrios SV1GL. Besides the necessary adjustments and the placement of a duplexer, he is thinking of changing the frequencies from R2 to R7.

Kostas SV1OE, is quite an active radio amateur, one of the few hams who are working RS satellites, and the only one in Greece who makes moonbounce QSOs. His location is close to Hymetus Mountain, about 6 kilometers from the center of Athens. His shack is composed of Kenwood and Yaesu VHF rigs and he uses a Kenwood transceiver for HF. His antennas are a set of four (F9FT) yagis and several dipoles for HF. He is active on the 1296-MHz nets, using the yagi and a parabolic antenna of his own construction. Kostas transmits the A5 mode and his 3-D pictures were really impressive. He is anxious to work the Phase III satellite.

A visit to the Voice of America installation was made by the radio amateurs of Greece. At this visit, a demonstration of high-power transmitters and antennas was given at the transmitter site of Xanthi, Greece. Most of northern Greece's radio amateurs attended, and Bad SV0BK, deputy director of the station, was present at the dinner. He showed them the big complex of antennas used and the transmitters and the voltage generators that keep VOA independent from power lines.

Attention: Here is required reading for any radio amateurs coming into Greece and bringing their gear. It is against the law to bring a radio into the country if a permit has not been issued by the Ministry of Communications. If caught, you may be charged with illegal possession and/or use of radio, with up to two years imprisonment and/or up to a $2,500 fine as punishment.

Konstantinos Gioulseren SV1OE.

ITALY

Mario Ambrosi I2MQP
Via Stradella, 13
20129 Milano, Italy

On April 20, 1983, San Marino amateurs changed their prefix. The new one is T77. You will also have the possibility to work them with a T71 prefix that will be released only during contests and through the club station, T70A.

The Yaesu FT-980 has been released for the Italian market; the price should be around $2400. If you are interested in buying something here, some of the most common prices in the market are: TS-930—$2200, TH7DXX—$550, 3-500Z—$145, KLM 34XA—$750, and *Callbooks*—$60. Luckily for us, our salaries are generally lower than the American ones. Otherwise we could end up buying too many rigs!

In Italy, the new WARC bands have not yet been released, though we do hope to get them shortly. Some of us have been authorized to use 160 meters during contests in 1982/83, but now this frequency is again completely off limits. We do not have even 50 and 220 MHz, and as a result, the 2-meter band is incredibly crowded (only two MHz are used, from 144 to 146).

Repeaters are working in the 145.500/145.800 segment, with a 600-kHz split. The 432-MHz frequency is starting to become quite common, and repeaters are starting to be installed in the main cities.

We have two classes of licenses, a VHF one that does not require any code proficiency test and allows you to use 144 MHz and up with a maximum input power of 10 W, and an HF class with a code proficiency test of 8 wpm which permits use of all frequencies with a maximum input power of 300 W. As a result of the easiness to obtain the first license, there is a lot of activity in the VHF sector. To give you an idea, here are some of the distance records of the local VHFers on 144 MHz: I4EAT, 7788 km, using F2 propagation, I0AKP, 3628 km, using sporadic E, and I4EAT, 2500 km, using meteor scatter.

I4EAT has a personal record of 57 countries worked, and 22 other hams have obtained more than 20 countries.

A recent announcement has been made about the discovery of a new elementary particle. It is called the W particle. The discovery has been made in Geneva by a team of 134 European and American scientists headed by an Italian. Many other Italians participated in this W particle project; a major position is held by Giorgio Goggi I2KMG from Pavia, a city close to Milano. I2KMG has just been credited with his country 342/318, thanks to the BY1PK card that was his last missing one, and that places him in the first position on the DXCC Honor Roll.

It's amazing to discover that I2KMG has been able to perform such an impressive achievement on the air and in the lab considering also that his QRL is more than 200 miles from his QTH and that he can devote time to DX only during the weekends.

Of the new particles, it has been said that it is not yet 100% proven they really are Ws, but that they "walk like Ws and talk like Ws"; let's hope they will not make too much QRM during pileups!

A new award was introduced in March by the Italian Amateur Association (ARI), the Italian Islands Award. To obtain the award, you must reach 10 points contacting different islands (or the same one on different bands). Full details on this award and others will be made available to you in the future in this column. If you have a particular interest in Italian awards, write to: Award Manager, ARI, Via Scarlatti 31, 20124 Milano, Italy.

During the first quarter of 1983, most of the interest of active hams in this country was devoted to the various contests—in particular, the *73* 40- and 80-meter contest, the ARRL DX contest, and the WPX. Big guns participate in them, fighting for the first positions, and small fishes take advantage of the situation to hunt for new states or for new prefixes.

This year, propagation has not been too good on the higher bands, but good openings have been found on 40 and 80; W6s and W7s have been worked easily without too much power or big antennas. Good scores have been claimed and some records surely will be broken.

Other records are: on 432 MHz, I0MNI with 1520 km; on 1296 MHz, I0SVS with 1520 km; on 2304 MHz, I1PE with 267 km; on 5670 MHz, I1RIP with 183 km; on 10 GHz, I0SNY with 1166 km; and on 24 GHz, I3SOY with 73 km.

ANTARCTICA

Harry A. Mills W4FD
Box 409 Bullard Route
Dry Branch GA 31020

Gene Brizendine W4ATE
600 Hummingbird Dr. SE
Huntsville AL 35803

Brian Combs KA3JXR/KC4 contacted us in mid-October, 1982, seeking a high-performance, low-angle antenna suitable for long-haul amateur communications at the South Pole. Happily, the Controlled-Current Distribution antenna, (see Refs. 1,2,3), which has been in continual development by W4FD since 1959, amply fills these requirements.

Excitement ran rampant among the three of us, because Brian would have an outstanding antenna, and our CCD would be in the spotlight for the world to see what it can do.

Since Brian's scheduled departure time was October 25, W4FD immediately began the assembly of three CCD dipoles, for 7, 14, and 21 MHz. Each was of very rugged construction, necessary to endure the load of the incessant west wind, massive snowstorms, and temperatures which plunge to 100° F below zero.

Siple Station is located at the base of

the Antarctic Peninsula at 75° 55' S, 83° W on ice and over 4000 feet above sea level. Since the ice is salt-free, it provides a really tall antenna-supporting insulator.

Here, the National Science Foundation will continue to investigate the response of the Earth's magnetosphere to the injection of coherent ultra-low-frequency (ULF) waves in the 2–3-kilohertz range. This response includes wave growth, spectral broadening, development of sidebands, triggering of ULF emissions, wave coupling, and particle scattering. The existing doublet for injecting the ULF waves lies on top of the accumulated snow and is 13 miles (21.4 kilometers) long. During the present Austral summer, the enormous antenna will be raised above the surface and its length doubled.

During 1983, transmissions will be made to such satellites as the Dynamics Explorer-1, the ISIS-1, and the ISIS-2 and to support the SEEP (Stimulated Emission of Energetic Particles) experiment. This is an extremely brief glimpse of the Antarctic investigations under the direction of scientists at Stanford University, the University of Minnesota, the University of New Hampshire, Bell Telephone Laboratories, and Utah State University, in cooperation with the British Antarctic Survey.

Brian KA3JXR/KC4 is age 32, married, and the son of a minister. He has a great interest in QRP operating, the outdoors, and boating. On October 26, he departed California for New Zealand, for fitting of winter clothing. He then went to McMurdo Base to await weather suitable for a safe landing at Siple Station.

Until about the end of January, mail service is through FPO, San Francisco, New Zealand, and McMurdo Base. From there it is distributed to Siple and South Pole Stations by C-130 aircraft.

Brian writes (Nov. 30): "We have now gone over a week without mail or any planes. However, life here is not hard. We are warm and comfortable, with plenty of food, which is all that anyone could ask. During the Austral summer months, we may have as many as 40 people at the station, doing various construction projects, the major one being to extend the ULF dipole to 26 miles. By the end of January, only eight of us who are staying for the winter will be left, to keep the station running on our own without outside help.

The P-Band antenna at Siple Station, Antarctica, is used to receive data from Nike-Tomahawk rockets launched into the magnetosphere (US Navy photograph).

"I am looking forward to using the three CCD antennas. I expect to be on the bands regularly; also, other members of the station will be using the equipment, so the overall use should be quite high, because there will be no mail until November, 1983. The CCD antennas also sound just right for my QRP operations on CW around 21.170 MHz, beginning around the end of December.

"We have plenty of coax and fittings of all sizes that we will likely need.

"During the present heavy work schedule, several plans for amateur construction are being considered. The problem is that the conduit carrying the coaxial transmission lines to the tower is under 40 feet of snow. The major idea at present is to utilize the aurora hut for a shack, where we would install a Collins KWM-2 and the HW-8. This plan gives a reasonable overground run to the tower. A patch board would be constructed, to mix and match equipment.

"Due to commercial schedules, we are not able to meet the Sunday and Wednesday schedules originally planned for amateur operating. We do come up a couple of times per week, after 2000 hours our time, on the Maritime Mobile net on 14.313 MHz SSB (catch us there for any traffic). All our linears are one kilowatt. I had not heard that 10 MHz had opened up. We will try to find a crystal for that band.

"We did not expect the 7-MHz CCD antenna which you provided; it should make life very interesting, indeed. Forty meters doesn't really open up for us until sunset begins. This 24 hours of daylight is quite hard on communications. Twenty meters is our best band by far. It is the only one that we can count on. Several hams have asked me on the air about the CCD antenna; they all want to learn more about it. It should be an interesting year!

"I have had my first experience with a pileup! For a newly-licensed ham who is still trying to master the basics (like moving from a net and finding the other station), a pileup is quite something. When it happened, I had to shut down before giving every station a QSO. Patience seems to be the key to keeping everything reasonably under control (perhaps some Valium wouldn't be a bad idea, either). Perhaps I could work more stations if I only gave RST reports. But I don't think that is fair, so I spend some time with every QSO.

"I expect to use off-duty time for studying to fill the gaps in my knowledge, so that I can take the commercial examination for radio telegraphy and maritime endorsements and the exam for the amateur Extra.

"The weather so far has been remarkably good. We have gone 9 days with clear sunny skies. But very soon we will be getting 5-6-day snows and winds. That is the "whiteout" that you have heard of, when you often can't see more than a few feet in front of you; still, there is work out there to be done. The Antarctic is easily one of the most beautiful places that I have been. The work is hard and often long, but we are getting a lot done."

The zero humidity in Antarctica results in violent lightning and atmospheric disturbances, as well as auroral effects, which subject antennas to many-thousand-volt stresses. For this reason, drain resistors were installed across the capacitors in the largest (7-MHz) CCD dipole. The heavy wind loading is a major structural consideration which was met by assembling each antenna on a length of 500-pound-test monofilament fishing line as a supporting messenger. Two 300-pound-test monofilament lines were then spiralled around the entire length of the antenna, in opposite directions, with frequent ties. Survival of the antennas now depends upon the monofilament lines remaining flexible and not crystalizing in the extreme sub-zero temperatures. Ends of the 500-pound-test messenger lines extend beyond the antenna ends to serve as insulators and also to provide a means for anchoring.

Ideally, the CCD dipole is fed by 300- or 450-Ohm transmission line through a 1:4 balun located directly at the transmitter output. This provides the best current balance and bandwidth, and band-changing is then only a matter of turning the transmitter bandswitch. No matching network or tuner is needed. However, at Siple, the violent winds dictated the use of coaxial line, which has a better chance for survival than even the heavy commercial-size twinlead-line types. Also, the antenna tower being over 100 feet away, a considerable run of line is exposed to possible damage by nature's elements.

The call KC3AAD will be used by another staff member at Siple Station. Phone patches to families and friends will be made on 14 and 21 MHz and have first priority. Brian asks only that callers wait until these are cleared, then general contacts on SSB and CW are welcomed. The most reliable band in the Antarctic has been 14 MHz, so more activity is expected there. All contacts will be confirmed by Brian's QSL upon his arrival home following the 15-month tour.

A CCD antenna net was recently formed by a group of enthusiastic users in the Oklahoma area. Anyone interested in a better antenna is invited to join N6ATS and the group on 7.203 MHz (3.843 MHz, alternate) at 0100 UTC daily.

For construction data for the improved CCD, send an SASE to either of the authors.

References

1. Harry A. Mills W4FD and Gene Brizendine W4ATE, "Antenna Design, something New," *73*, October, 1978, page 282.
2. Harry A. Mills W4FD and Gene Brizendine W4ATE, "The CCD Antenna—Another Look," *73*, July, 1981, page 50.
3. Harry Longerich W4ANL, "The CCD Antenna Revisited," *73*, May, 1982, page 40.

HAM HELP

I would like to get in touch with any hams knowledgeable in using the Timex/Sinclair 1000 computer for Morse, RTTY, and other applications.

Martin E. McCoy WB8TCZ/7
1365 N. 9th
Laramie WY 82070

If anyone can supply me with the manual and schematic for a Lafayette HE-89 vfo, I will pay for the copying and postage.

Greg Dickerson N4DBS
12453 Northwood Rd.
Savannah GA 31406

I am compiling a list of access codes for repeaters, and I need input from *73*'s readers. Access codes for open autopatches will be listed with permission; access codes for closed (member-only) autopatches will not, but information about how to join will be included. Also, please indicate repeater power, antenna height, coverage, and autopatch exchange. Lists will be sent to all who contribute, and others may receive it for an SASE and copying costs. I would also like to hear from others in the EMS and forensic medicine fields (I am a CEMT and Deputy Coroner).

Jeff Howell WB9PFZ
PO Box 187
Milton KY 40045

I need someone to design and build a frequency converter to convert frequencies in the male voice range to the female voice range. I need to be my own secretary.

H. J. Hannifan N5EXI
PO Box 812
Shawnee OK 74801

Neville G. Harleck
Monitor Instruments
PO Box 116, Rosebery
Sydney, 2018
NSW Australia

Colin Dawson
Electronics Australia
PO Box 163
Chippendale, 2008
NSW Australia

Down-Under Depth Sounder

Get your feet wet with this Australian construction project. We promise that you won't get in over your head.

Reprinted with permission from the November, 1982, issue of *Electronics Australia*, PO Box 163, Chippendale, 2008, NSW Australia.

Depth sounders on pleasure craft are primarily used for simply measuring water depth, although some more elaborate (and expensive) models can locate fish or even produce a scan of the sea bottom so that reefs and other sunken objects can be located. The unit described here falls into the former category and, as such, is designed to be easy to construct and to operate.

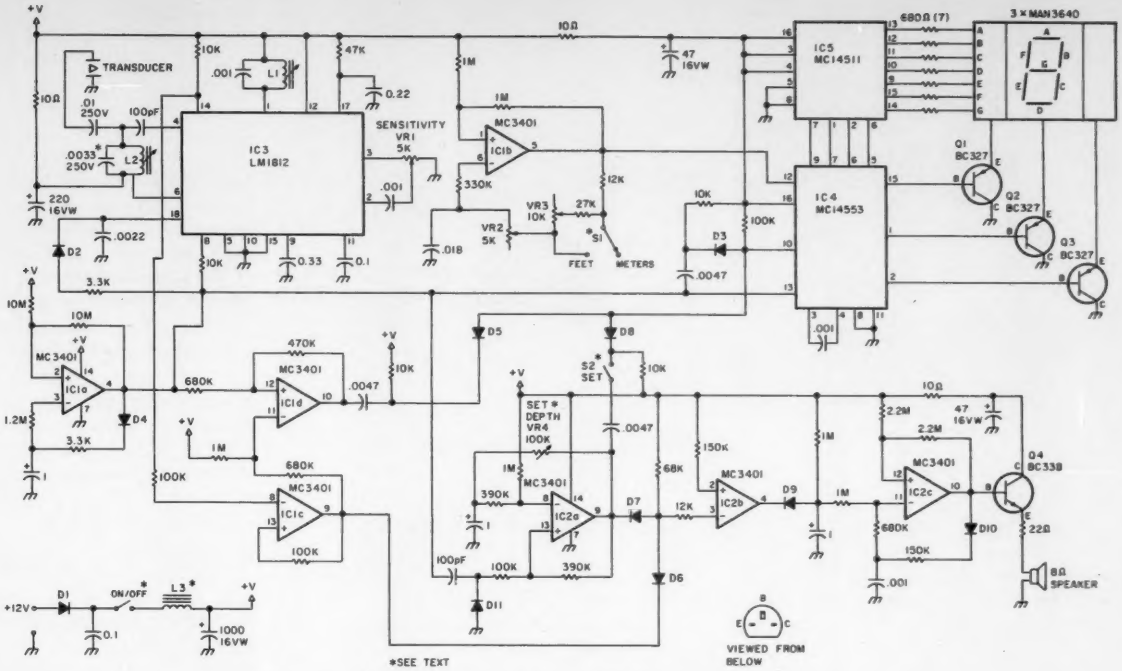
After all, what could be easier than reading a few numbers off a digital display?

Photo A. The digital depth sounder.

The circuit was developed by Sydney engineer Neville Harleck whose company, Monitor Instruments, can supply complete kits for the project. We at *Electronics Australia* simply assembled the unit depicted here and prepared the constructional details.

Once assembled, the kit certainly looks the part. Two printed circuit boards—a display board and a main board—accommodate virtually all the electronics, and these are housed in a white molded plastic case. Overall case dimensions are a compact 125 mm W × 140 mm D × 58 mm H.

While the case is not watertight, it is reasonably weatherproof and should stand up well to the rigors of the marine environment. Its compact size also means that you should have no difficulty in finding a suitable mounting position for the device regardless of the type of boat you own.



Circuit diagram for the digital depth sounder.

Other features include a bright 3-digit LED display, a sensitivity control, an alarm-depth-set control, and a feet/meters switch mounted on the rear panel. A U-shaped mounting bracket allows the case to be tilted to provide a convenient viewing angle.

The audible alarm function is a particularly useful feature. When selected, it sounds whenever the water depth decreases below a preset level, thus eliminating the need for continuous visual monitoring. The danger of running aground is never greater than when the fish are biting, or you are otherwise preoccupied!

Basic Principle

The principle on which a depth sounder operates is quite straightforward. An ultrasonic sound pulse is directed into the water and the time taken for the signal to be reflected from the bottom is measured. Since the speed of sound in water is reasonably constant, the distance the sound pulse has traveled, and hence the water depth, can be easily calculated. Fig. 1 shows the essential elements of a depth-sounder system.

First, the transmitter generates a short pulse of 200-kHz energy and, at the same time, starts the clock. The receiver subsequently detects the reflected signal and produces a pulse that stops the clock. If the clock is counting at the correct rate, then the display will indicate the water depth directly in the appropriate units (meters or feet).

Most of the important functions of the transmitter and receiver circuits are incorporated into a single IC made by National Semiconductor. This IC, designated the LM1812, has been around for some years now and greatly simplifies the design task for a practical depth sounder. Fig. 2 shows the block diagram of the complete unit and should be studied in conjunction with the circuit diagram in order to understand how the instrument operates.

Circuit Description

Our circuit description starts with IC1a, which functions as the timebase clock. This generates a 1-ms pulse approximately every 800 ms. This pulse activates the transmitter and resets the display and alarm functions.

IC1a, part of an MC3401 quad op amp, is wired as an astable multivibrator which

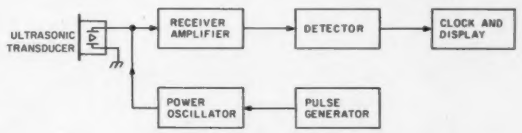


Fig. 1. Basic scheme for an ultrasonic depth-sounder circuit.

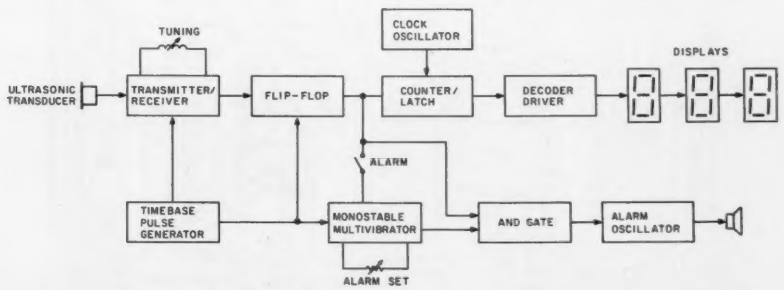


Fig. 2. Block diagram of the complete depth-sounder circuit. The transmitter/receiver is based on a single IC.

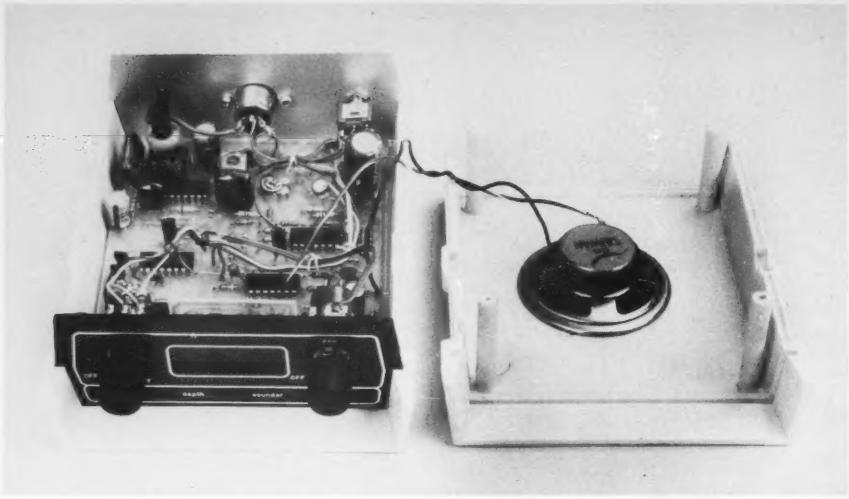


Photo B. Virtually all the circuitry is accommodated on two PC boards.

functions as follows: At switch-on, both the non-inverting input (pin 2) and the output (pin 4) are high. The 1-μF timing capacitor now charges via diode D4 and its series 3.3k-Ω resistor. When the voltage across the capacitor (and hence on pin 3 of IC1a) reaches a critical level, the output of IC1a goes low.

Since diode D4 is now reverse biased, the timing capacitor discharges via the 1.2-megohm resistor into pin 3 of IC1a. When the voltage on pin 3 goes low enough, pin 4 switches high again and the whole cycle is repeated. The 10-megohm resistor between pins 2 and 4 provides positive feedback to speed up the switching transitions.

The output of IC1a thus consists of a train of short positive-going pulses. These pulses are coupled to ultrasonic transceiver IC3, counter IC4, and to the non-inverting input of IC2a which controls the alarm function.

IC3 is the LM1812 transceiver chip referred to earlier. Both the transmitter and receiver sections share a common tuned circuit, consisting of L1 and the .001-μF capacitor, which makes for easy tuning. Readers are referred to the *National Semiconductor Linear Databook* for a detailed description of this IC, as only a general description of its operation will be given here.

The timebase pulse from IC1a is applied to pin 8 of IC3 via a 10k-Ω resistor. This causes the transmitter to "fire" at a frequency determined by the tuned circuit, the output signal appearing at pin 6. This is coupled to the transducer via L2, a parallel 3300-pF capacitor, and a .01-μF blocking capacitor. The signal appearing across the transducer thus consists of a 1-ms burst of 200-kHz energy of about 150-200 V peak-to-peak. At the end of the 1-ms clock pulse, IC3 reverts to the receive mode.

Signals picked up by the transducer are coupled into the first receiver stage at pin 4 via a 100-pF capacitor. Following amplification, the signal appears at pin 3 and is coupled into the next amplifier stage via VR1, the sensitivity control. It is this stage that is tuned by the LC network on pin 1.

As far as the user is concerned, the signal is not seen again until it appears at pin 14, and by this time it has been amplified, detected, shaped, clamped, and clipped so that we get a nice clean negative-going pulse from the supply voltage to ground.

The functions of a few other pins on IC3 should also be considered before moving on to the next section. It will be noticed that the timebase pulse is also fed into pin 18 via a 3.3k-Ω resistor and series diode D2. This is done to inhibit the detector during the transmit time and thus prevent a false output signal appearing at pin 14. The 47k-Ω resistor and 0.22-μF capacitor connected to pin 17 provide a measure of impulse noise rejection.

The 0.33-μF capacitor on pin 9 is charged during the transmit period and serves to inhibit the second stage of the receiver. As the

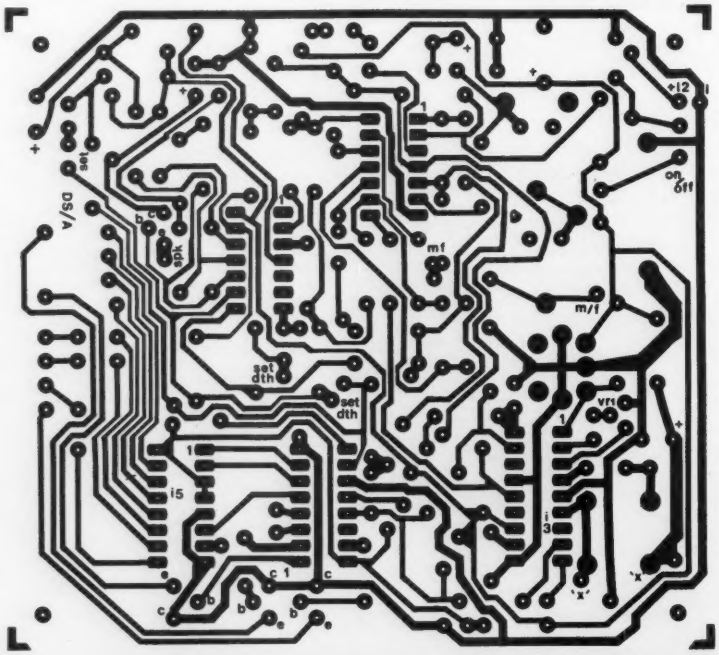


Fig. 3. PC board for the depth sounder.

voltage across the capacitor falls (at the end of the transmit period), the gain of the second stage increases. This has the effect of filtering out signals received during the first few milliseconds after the transmit pulse. Without this effect, echoes from the boat's keel or rudder could falsely trigger the display circuitry and cause an incorrect reading.

The output signal appearing at pin 14 is coupled to IC1c which functions simply as an inverter. The inverted signal is then fed to IC1d which is connected as a monostable and functions as follows.

Pins 9 and 4 of IC1 are normally low and, because of its 470k-Ω feedback resistor, IC1d will be latched either high or low. When a timebase pulse occurs, pins 12 and 10 are forced high, and the feedback resistor latches the device in this state. When an echo is subsequently received, it produces a positive pulse at pin 9 which is coupled to the inverting input of IC1d and hence forces pin 10 to go low.

Thus, the time that pin 10 stays high is the time from transmit pulse to received echo. Note that pin 10 stays low until the next transmit pulse, which means that any echoes occurring after the first have no further effect on IC1d. Multiple echoes are thus ignored.

The signal at pin 10 of IC1d is differentiated and the negative-going pulse coupled via diode D5 to the latch-enable input (pin 10) of counter IC4.

IC4 is an MC14553 3-digit BCD counter with multiplexed outputs. The counter is reset to zero by the timebase pulse on pin 13 and the trailing edge of this pulse is used to enable the latches in the chip (thus displaying 000); i.e., the timebase pulse is differentiated by a .0047-μF capacitor and a 10k-Ω resistor and the resultant negative-going pulse coupled to the latch-enable input of IC4 via D3.

As soon as the reset pulse has finished, the counter starts counting clock pulses from IC1b. When an echo is received, a negative-going pulse is coupled through to pin 10 via diode D5 as above, and the counter data is transferred to the latches for decoding and display. The next transmit pulse again resets the counter and displays to zero and the cycle is repeated.

Note that if no echo is received, the displays will remain on zero. This is because a latch-enable pulse must occur before data can be transferred to the latches.

IC5 is a BCD-to-7-segment decoder/driver chip which decodes the binary data from IC4 to drive common cathode 7-segment LED displays. Since the displays are multiplexed, the corresponding anodes are wired in parallel and connected to the outputs of IC5 via 680-Ohm current-limiting resistors. Each display cathode is connected to the emitter of a BC327 PNP transistor (Q1, Q2, and Q3), and these transistors are turned on and off by signals from the multiplexer in IC4.

If you like, you can regard the counter, decoder, and display circuitry as a "black box" controlled solely by the timebase pulse, the latch-enable pulses, and the clock pulses on pins 13, 10, and 12 of IC4 respectively.

Clock pulses for IC4 are derived from IC1b which is connected as a multivibrator and runs continuously. Its frequency is controlled by the .018-μF capacitor in company with VR2, VR3, and the 27k-Ω and 12k-Ω feedback resistors. Switch S1 shorts out VR3 and the 27k-Ω resistor, thus changing the oscillator frequency so that the display can read directly in either feet or meters.

The clock frequencies for IC1b are derived as follows: The speed of sound in water is approximately 1500 m/s and is fairly constant over

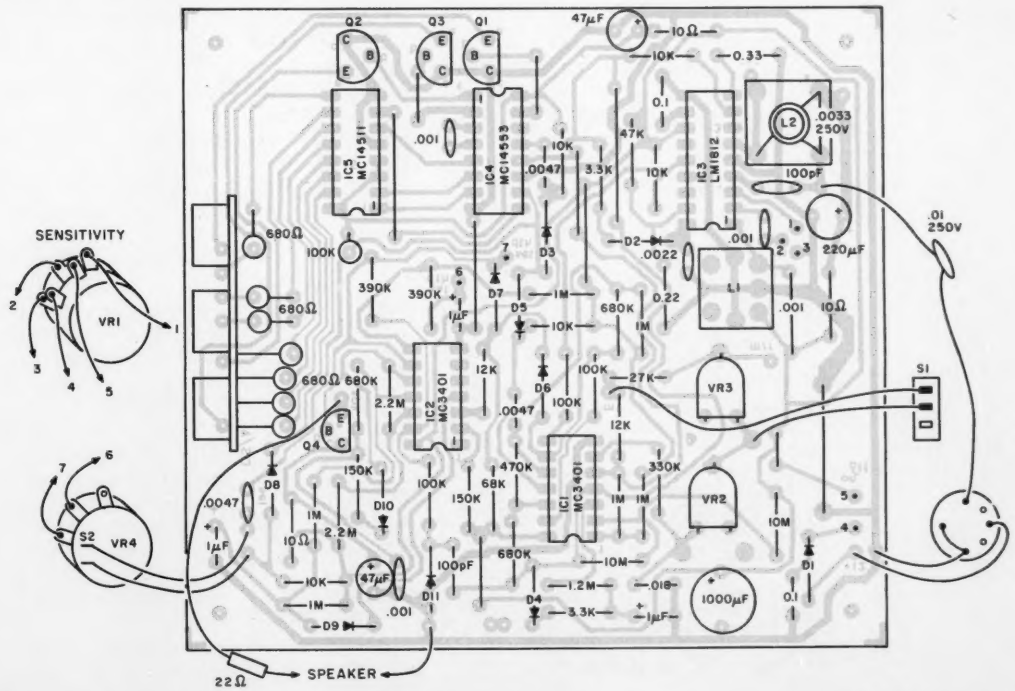


Fig. 4. Parts placement for the depth sounder. Take care with component polarity, and note that IC4 is oriented differently than the other ICs.

quite a wide range of temperature and salinity. It will therefore take 1 second to receive an echo in 750 meters of water, since the sound pulse has to go down and up. Thus, if the clock is set to 750 pulses per second, the counter will count up to 750 and the water depth will be displayed directly in meters.

If we want the display to read in feet, then the oscillator frequency can be found simply by multiplying 750 by 3.28 (the conversion factor from meters to feet), which gives 2460 Hz. Thus, the clock must run at 2460 Hz for feet and 750 Hz for meters. A fathoms display could be achieved with a clock of 2460/6 = 410 Hz.

Finally, we come to the alarm function. The depth at which the alarm sounds is set using front-panel alarm-set control VR4. First, the alarm-set control is pulled out to display the alarm setting. The control is then rotated until the display reads the required alarm depth and then pushed in again. The display immediately reverts to the water depth and, if this is less than the alarm setting, an audible warning is produced.

All alarm functions are controlled by IC2, an MC3401 quad op amp. IC2a functions as a monostable multivibrator, the period of which is determined by VR4 and the 1-μF timing capacitor. The monostable is triggered by the timebase pulse which is coupled in via a 100-pF capacitor and causes pin 9 to go high, thus reverse biasing diode D7.

If an echo is received while the monostable output is high, then both D6 and D7 will be reverse biased for the duration of the echo pulse (i.e., for as long as pin 9 of IC1c remains high). This causes pin 3 of IC2b to go high and the pin 4 output to go low. Since it is now forward biased, the anode of diode D9 also goes low, enabling oscillator IC2c to start up.

IC2c is a voltage-controlled oscillator whose frequency depends on the voltage at the anode of D9, i.e., the charge on the 1-μF capacitor. Initially, the 1-μF capacitor is discharged and the oscillator starts at a high frequency. When the echo pulse ends, D9 is reverse biased again and the 1-μF capacitor charges towards the positive supply rail via a 1-megohm resistor. As the voltage across this capacitor rises, the discharge current from the .001-μF capacitor slows and the output frequency drops lower and lower until eventually the oscillator stops.

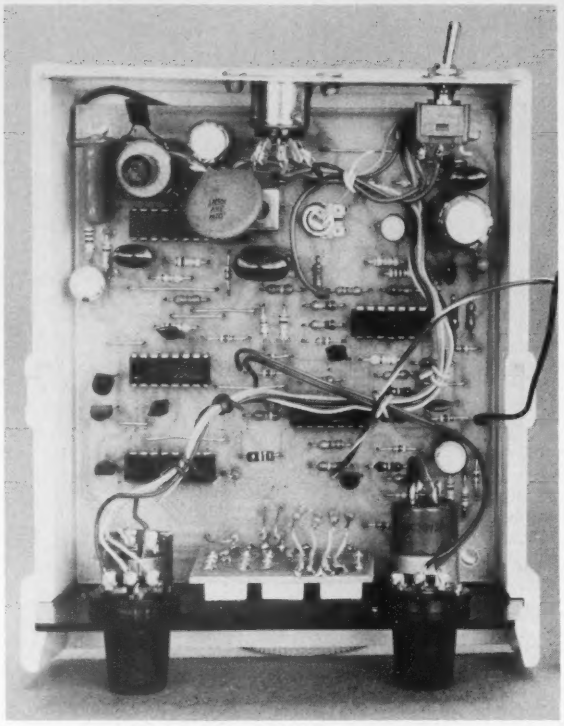


Photo C. Close-up view of the completed PCB assembly. Note that the seven 680-Ohm resistors adjacent to the display board are mounted end on.

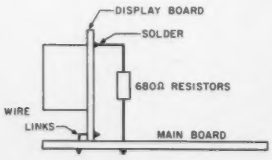


Fig. 5. Diagram showing how four of the 680-Ohm resistors are mounted.

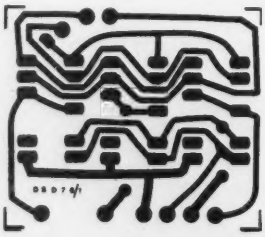


Fig. 6. PC board for the display.

3 × MAN 3640

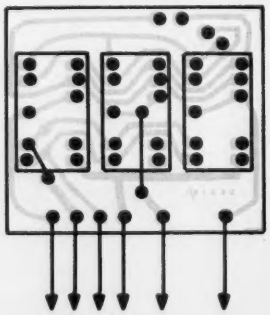


Fig. 7. Parts placement for the display PCB.

NPN transistor Q4 simply functions as a buffer and drives a small loudspeaker in its emitter circuit via a 22-Ohm resistor. The result is a siren-like note pulsed at the timebase frequency.

The alarm can sound only if an echo pulse is received while the output of monostable IC2a is high. Thus, it is the monostable pulse width that determines the alarm depth and this is displayed by using the trailing edge of the pulse to trigger the latch enable (pin 10) of counter IC4.

First, however, the echo pulse must be disabled, and this is done by setting the sensitivity control (VR1) to minimum. The output of monostable IC2a is differentiated by the .0047-μF capacitor and the negative-going pulse produced at the trailing edge coupled via switch S2 (on the back of VR4) and diode D8 to the latch enable of IC4. Since the timebase simultaneously resets IC4 and enables IC2a, the display will now show the alarm depth in the appropriate units.

Power for the circuit is derived from a 12-V battery (normally fitted to the boat). Diode D1 provides protection against reversed supply polarity, while 0.1-μF and 1000-μF capacitors provide supply decoupling and filtering. Choke L3 is not supplied as part of the kit and is not fitted unless problems are encountered with ignition interference (see Construction).

Construction

Construction can begin with the assembly of the main PCB according to the overlay diagram. Insert the wire links first, followed by the resistors, capacitors, coils, diodes, and transistors. Take care to ensure that all polarized components are mounted the right way round.

The ICs should be inserted last. Note that IC4 and IC5 are CMOS devices and

should be treated accordingly. When soldering these devices, ground the barrel of your soldering iron to the ground track on the PCB (use a small clip lead) and solder the supply pins (8 and 16) last.

The display PCB should be assembled next. Watch the orientation of the displays and note that the links must go in first. The display board is mounted on the main board using six tinned copper-wire links along the bottom edge. In addition, four of the 680-Ohm current-limiting resistors are mounted between the main PCB and the display PCB and, if these are bent as shown in Fig. 3, will provide additional support.

The front-panel controls can now be mounted in position and the red perspex window cemented in place using epoxy adhesive. This done, wire the controls to the main PCB and fit the DIN socket and feet/meters switch to the rear panel.

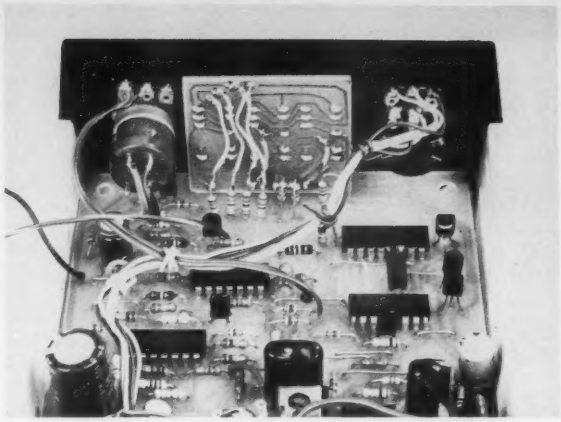


Photo D. Front panel and display PCB details. Note that the spare switch pole on the alarm-set control can be used to automatically disable the echo pulse (see text).

Complete the wiring according to the main wiring diagram and Fig. 3.

Although not part of the original design, the circuit can be easily modified so that the echo signal is automatically disabled whenever S2 is closed. As supplied, there is a spare switch pole on the back of VR4, and this may be used to disable the echo signal by connecting it between pin 2 of IC3 and ground. With this simple modification, you won't have to fiddle with the sensitivity control each time you wish to display the alarm depth.

The loudspeaker is fitted to the top half of the case (over the slots) by gluing it in place with contact adhesive. A piece of cloth is provided to cover the slots. Connect up the speaker, fit the transducer DIN plug with a couple of flying leads for the power connections, and you are ready for the smoke test!

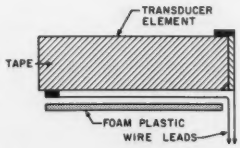
Apply power (12 V) and switch on. All being well, you should be greeted by a chirp from the speaker and the display should read 000 or 001. Make sure that the alarm-set control is pushed in and fully anticlockwise (i.e., alarm off).

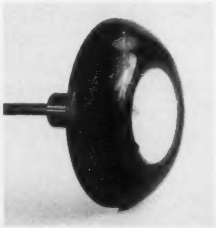
Now set the sensitivity control to minimum (to disable the echo pulse) and pull out the alarm-set control. Slowly rotate the alarm-set control clockwise and check that the display shows progressively higher numbers. If this check is OK, operate the feet/meters switch and check that the display changes by a 3:1 ratio. With the alarm-set control fully clockwise, the display should read a maximum of approximately 30

TRANSDUCER ASSEMBLY

Begin the transducer assembly by gluing together the two plastic pieces forming the element housing. These are molded in ABS, so use a suitable styrene adhesive. Apply adhesive sparingly to the top edges of the "fried-egg"-shaped piece and then press the two parts together, ensuring that the mounting holes are correctly aligned. Allow sufficient time for the adhesive to dry.

The barium titanate element must be prepared next. Carefully tin a small spot close to the edge of the element on each side and solder a short length of hookup wire to each spot. Be very careful with this operation, as too much heat will burn the silver off the surface of the element. Wrap the circumference of the element in plastic tape, using the tape to hold one of the wires against the edge.





The surface where the two wires emerge is now the rear face of the transducer. Now lay the wire from the rear surface against the transducer and place the plastic foam disc in position. Use more tape to secure it in place. The two wires should now emerge from one side as shown and should be reasonably well supported by the tape. Leave about 25 mm of wire free and strip and tin 3 mm at the end of each wire.

Force one end of the coaxial cable through the hole in the stem of the housing and strip and tin the ends of the braid and the center conductor. Carefully solder the coax to the wires coming out of the transducer assembly and insulate the joints with more plastic tape.

The transducer assembly must now be pushed into the housing, carefully pulling the coax down to avoid building up a loop of cable behind the transducer.

Push the transducer down in the housing so that its front surface is about 3 mm below the lip of the housing cavity. Check the cable at the other end for shorts; if all is well, put your meter on a low ac voltage range and tap the transducer with a screwdriver handle. You should see the meter give a kick, indicating that the transducer is functioning correctly. If not, check your connections carefully.

Support the transducer assembly face up, where it can be left overnight, and you are ready for the epoxy resin encapsulation. Do not use 5-minute epoxy. You must obtain some epoxy resin with a 6–12-hour setting time and carefully mix up enough to fill the transducer housing. After mixing, allow it to stand for about 20 minutes to allow the air bubbles to escape, then pour it into the transducer housing.

Fill the housing right to the top so that the transducer element is completely immersed and keep an eye on it for an hour or so, topping it as it runs down behind the element. Use a pin to prick any air bubbles that emerge. Take care here, as any air bubbles can drastically degrade transducer performance.

On no account should you use polyester resin—you must use epoxy. Epiglass 40 resin is quite satisfactory.

Finally, fit the DIN plug to the end of the cable, and fit the red and black supply leads.

meters (VR2 and VR3 roughly midrange).

Now turn the alarm off and the display should go back to zero. Turn the sensitivity control fully clockwise and lightly tap the face of the transducer with a screwdriver handle. The display should flicker and momentarily read some random numbers. If the alarm is now set to maximum depth, it may be possible to trigger it by tapping the transducer face as above. (It will trigger only if you "hit" upon an echo reading of less than the alarm setting.)

Calibration

If all the above tests work, your depth sounder is functioning and will give readings if taken out in a boat. However, it has to be tuned and calibrated if we are to obtain maximum sensitivity and if the readings are to be accurate. If you have access to the appropriate test gear, this can be done easily on the bench; if you don't have test gear, the only way is to take the instrument out on the water.

Assuming that you don't have test gear, the procedure is as follows:

- *Tuning.* Advance the sensitivity control until an echo is obtained, then back it off until the echo is just lost. Now tune L1 carefully until the echo reappears (display reading). Reduce the sensitivity again and continue the process until the optimum setting is found for L1. L2 can be tuned in the same way, but as this has a low Q, its setting is not so critical. Most units will tune with the slug of L2 about flush with the top of the former.
- *Calibration.* Once the tuning is done, the calibration can be set if you have a chart. The problem is to find a known depth of water and set VR2 and VR3 to the known depth. Do not forget to allow for the fact that the transducer may not be at the surface if it is mounted on the bottom of the boat; i.e., the instrument reads depth beneath the transducer.

It may even be possible to resort to the good old lead line to get an accurate depth measurement.

First, set switch S1 to the feet position and adjust trimpot VR2 until the display shows the correct depth. This done, set S1 to meters and adjust trimpot VR3. Note that VR2 must be set first as it affects the setting of VR3.

If you have access to an oscilloscope, a signal generator, and a frequency meter, the procedure is somewhat different:

- *Tuning.* Connect the oscilloscope probe to pin 1 of IC3 and couple in a 200-kHz signal to L2 via the .01-μF capacitor. Now adjust L1 and L2 for maximum signal strength.

If no signal generator is available, then it is possible to get a signal echo in air. Clamp the transducer to the underside of the workbench and check that the unit is over a hard floor (carpet will not reflect ultrasound). Once an echo is being received, simply tune L1 and L2 for maximum signal strength. (Note: Because of the much lower velocity of sound in air than in water, the display will read about four and a half times the actual distance.)

- *Calibration.* A frequency meter connected to pin 5 of IC1b will allow precise setting of VR2 and VR3 to 2460 Hz and 750 Hz respectively. Alternately, you can use a CRO or a frequency meter to set the periods to 406 μs and 1.333 ms respectively.

Once the unit is tuned and calibrated, it may be mounted in the case. To do this, lay the top half of the case (the half with the speaker in it) upside down on the bench and sit the circuit board on the four mounting pillars. Fit the front and back panels into the slots provided and fit the large brass nuts into the cavities in the sides. Ensure that the board holes line up with the mounting pillar holes and fit the bottom half of the case.

The two halves will fit together closely and the four 12 mm × no. 4 self-tapping screws may be fitted through the bottom holes and screwed into the mounting pillars. The U-shaped mounting bracket may now be attached with the large plastic knob-headed screws. Fit the front-panel control knobs, and your instrument is ready for use.

Operation

The transducer is the key to satisfactory operation of

Parts List

1 printed circuit board, 111 × 100 mm
1 printed circuit board, 41 × 35 mm
1 SPST toggle switch
1 5-pin DIN socket and plug
1 plastic case, 125 × 140 × 58 mm
1 front panel to suit
1 8-Ω loudspeaker
2 knobs
1 U-shaped mounting bracket
2 mounting knobs for bracket
1 ultrasonic transducer kit
2 slug-tuned coils, L1 & L2

Semiconductors

2 LM3900, MC3401 quad op amps
1 LM1812 ultrasonic transceiver
1 MC14553 3-digit BCD counter
1 MC14511 BCD-to-7-segment decoder
3 2N5819 PNP transistors
1 2N5818 NPN transistor
11 1N4001 silicon diodes
3 MAN3640 7-segment LED displays

Capacitors

1 1000 μF/16VW PC electrolytic
1 220 μF/16VW PC electrolytic
2 47 μF/16VW PC electrolytic
3 1 μF/16VW tantalum
1 0.33 μF mylar™
1 0.22 μF mylar
2 0.1 μF mylar
1 .018 μF mylar
1 .01 μF/250 V disc ceramic
3 .0047 μF mylar
1 .0033 μF/250 V disc ceramic
1 .0022 μF mylar
4 .001 μF mylar
2 100 pF disc ceramic

Potentiometers

1 100k linear potentiometer with DPST pull-on switch
1 10k mini-trimpot, horizontal mounting
1 5k mini-trimpot, horizontal mounting
1 5k linear potentiometer with SPST rotary switch

Resistors (¼ W, 5% unless specified)

2	10 megohm	1	68k
2	2.2 megohm	1	47k
1	1.2 megohm	1	27k
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1	330k	1	22 Ohms
2	150k	3	10 Ohms
4	100k		

Miscellaneous

Rainbow cable, tinned copper wire, solder, styrene adhesive, epoxy resin

any depth sounder, and a few tips on mounting may not go astray. Many people have mounted transducers inside the hull in a "waterbox" and it is possible to get satisfactory results with this method. However, some sound attenuation will occur and this will reduce the range of the instrument. In the worst case, it may not work at all.

The best mounting method is on the outside of the hull, roughly in the middle third of the boat and as close to the center line as possible. It must be clear of any fittings and in an area of clear water flow. Turbulence and bubbles under the transducer will reduce its performance. In yachts, hull-heeling under sail will cause the transducer to fire its sound beam out at an angle and this will reduce sensitivity; if the boat heels far enough, the echo may be lost altogether. Mind you, when this happens, the crew is usually too busy to be looking at echo sounders!

Installation of the unit should be straightforward, but keep the transducer and all leads as far away from the engine as possible to avoid ignition interference. If ignition interference does prove a problem (i.e., the display reading fluctuates randomly), choke L3 will have to be fitted in place of the appropriate link on the PCB. This should be a power supply choke of around 10 mH in value.

Because this choke is not available from Monitor Instruments, it will have to be purchased separately, if required.

The maximum depth range attainable with this instrument will vary considerably and depends on a number of factors including tuning accuracy, transducer mounting, water turbulence, and bottom reflectivity. Bottom reflectivity will be high with a flat sandy bottom and may be nil with heavy weed growing over soft mud.

A typical unit should give a depth range of from 80–120 meters without any difficulty and possibly more with careful tuning and installation.

Note that apparently strange readings can occur with this type of instrument because the display is triggered by the first echo received. For example, echoes may be received from cold layers in the water, undersea currents, propeller wash from other boats, and even fish. The usual effect of this is a steady bottom reading of 30 meters, say, with occasional readings of much less, e.g., a fish at 20 meters or a salinity or cold water layer at 15 meters, etc.■

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The sole supplier of the PCB, a proprietary design, is Monitor Instruments, PO Box 116, Rosebery, Sydney, 2018, NSW Australia. Any of the following ordered, when orders are received with payment, will be shipped within 5 days. Amounts are in US dollars.

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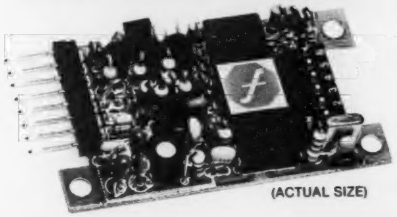
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The ROM-less, RAM-less CQ Sender

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Morse code can be generated automatically by various methods using memory chips like RAMs, PROMs, and EPROMs. If RAMs (Random Access Memory) are used in the design, the memory is temporary. That means if the unit is switched off, all the memory contents will be blanked unless there is a standby battery connected permanently. Providing a standby battery is not economical, at least for hams.

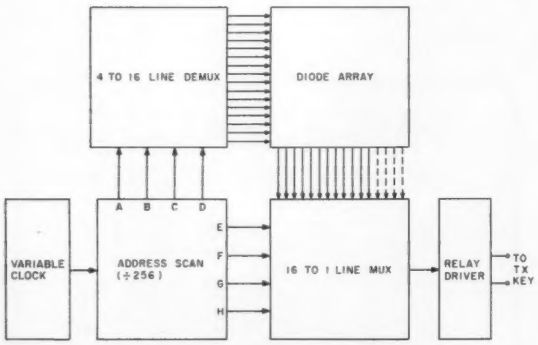
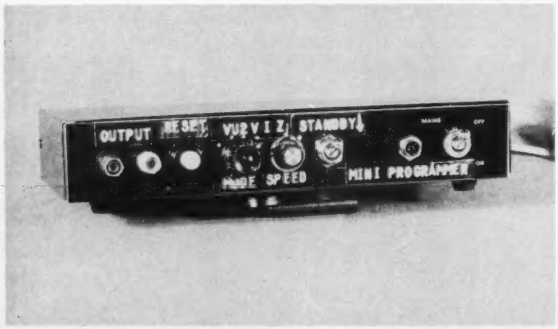


Fig. 1. Block diagram of CQ Sender.



The reprogrammable automatic CQ Sender.

ROMs (Read Only Memory) are programmed by the manufacturer according to the consumer's requirement and cannot be altered once programmed. But the programming is permanent, hence does not require a standby battery.

PROMs (Programmable ROMs) are identical to ROMs except that they can be programmed by the user. The big disadvantage is that the programming cannot be altered once programmed. Hence it will become useless if the callsign of the user is changed. Moreover, PROMs require a complicated setup to program. The IC becomes useless if greatest care is not taken while programming.

One is able to program EPROMs (Erasable PROMs) any number of times. They do not require standby power to retain their memory. The contents can be erased by exposing the IC to UV lights (UVEPROMs) or by electrical energy (EEPROMs). However, for each programming, a complicated separate circuitry with different voltage supplies and UV light to erase the contents are required. Many builders do not have and cannot afford to have what is required for this. Also, the EPROMs themselves are very costly.

Keeping all this in my mind, I have designed a "CQ Sender" which is equivalent to EPROM design in operation yet uses no EPROMs, PROMs, ROMs, or RAMs. My design has got all the facilities you can get using EPROMs, yet it does not require any separate programming circuitry or the UV light for erasing the contents! At first you may think that it is not possible, but I did it!

The block diagram of "CQ Sender" is shown in Fig. 1 and the schematic diagram in Fig. 2. It consists of the following:

- Clock-pulse generator, 7400 IC
- Address scan (÷256 counter), 2×7493
- 4-line-to-16-line 74154 demultiplexer
- Diode matrix—all 1N914 diodes

- 16-line-to-1-line 74150 multiplexer
- Switching transistor SL100 and relay

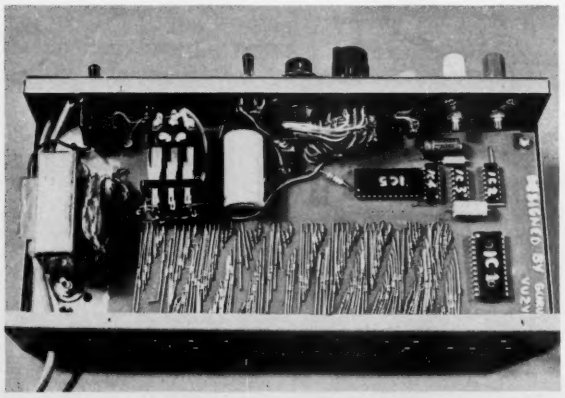
The *clock-pulse generator* is constructed using 2 inverters (a NAND is used as an inverter). The clock frequency is variable, enabling us to set the CW speed at any desired level.

The *address scan* is constructed using two cascaded 7493 chips (each ÷16 mode). An address scan is nothing but a ÷256 counter. It counts from 0 to 255 (256 states) and resets to 0 and starts counting once again. The clock output is fed to this counter's clock input. This means for every one clock pulse (falling edge) the counter advances by one count. The counter has 8-bit output lines (to represent 255 in binary form we need 8 bits), and out of these 8 lines the first 4 lines (starting from LSB) are applied to the demultiplexer IC and the remaining 4 lines to the multiplexer IC.

The *4-line-to-16-line demultiplexer* accepts a 4-bit binary output address and has 16 output lines. If a 4-bit binary output address like 0110 is applied to it, then the corresponding output line (no. 6) will go to the low level leaving all the remaining 15 output lines at high level. Since 4 output lines of the 7493 IC are fed to the "output address" of this demultiplexer, each of its output lines will go low and remain there for a duration determined by the clock frequency.

The *diode matrix:* While programming, each dot is considered as 1 unit, each dash is considered as 3 units, a character gap is 1 unit, a letter gap is 3 units, and a word gap is 5 units. Whenever a dot is required, the output from the appropriate line of the demultiplexer is taken through a diode. If a dash is required, then the outputs from 3 consecutive lines are taken through individual diodes and these diodes are bunched together. These bunches (columns) of diodes are then connected to the different input lines of the 74150 multiplexer.

Referring to the schematic diagram (Fig. 2), the first diode column consists of 8 diodes and the second column consists of 10 diodes. In the first column, the outputs of lines 2, 3, and 4 are taken to generate a dash and the output of line 5 is not taken (for 1 unit space). Then the output of line 6 is taken for a dot, while line 7 is not used (for a unit space). The outputs of lines 8, 9, and 10 are taken through diodes (for a dash), the output of line 11 is not used (for a unit space), and the output of line 12 is taken for a dot. This arrangement produces the code —·—· which is equivalent to the letter C. As per convention, a 3-unit space is given after the letter C (the outputs of lines 13, 14, and 15 are not used). In the



Interior view of the reprogrammable automatic CQ Sender.

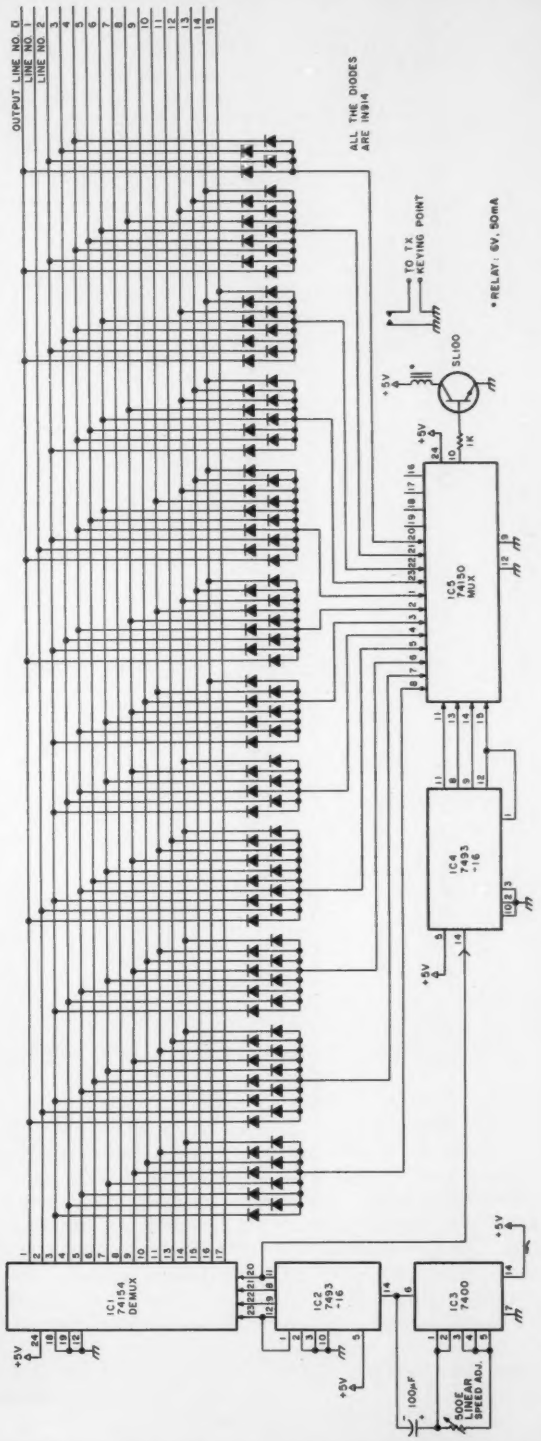


Fig. 2. Schematic diagram of the CQ Sender, programmed to call "CQ CQ DE VU2ARC AR K."

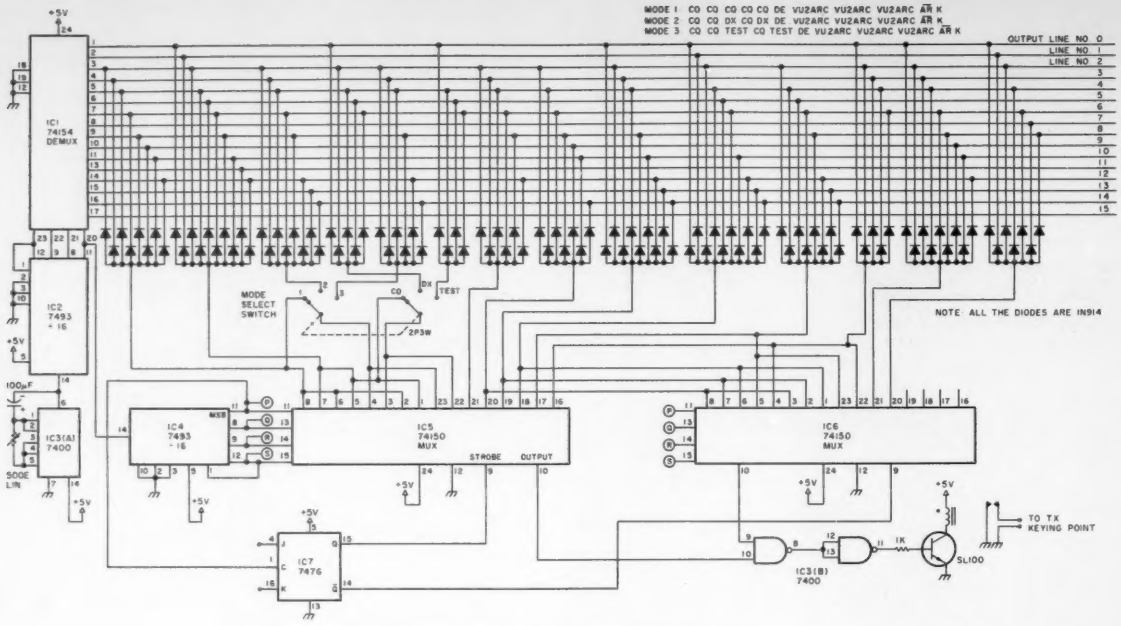


Fig. 3. Improved CQ Sender with different modes.

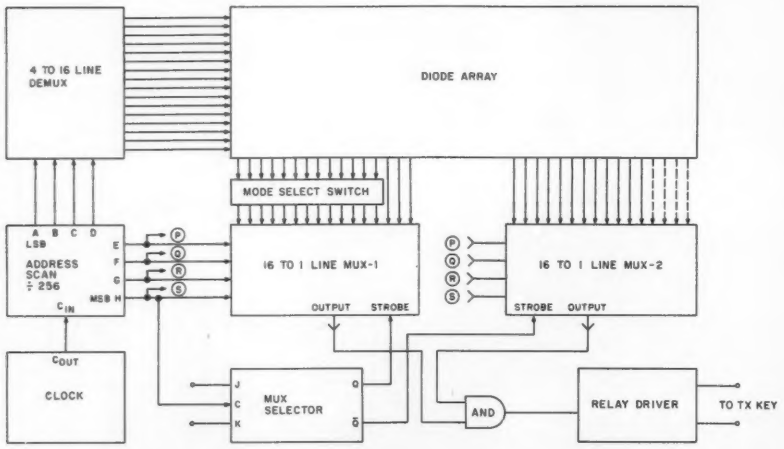


Fig. 4. Block diagram of the "improved" CQ Sender with different modes.

second column of diodes you will notice the letter Q is generated, in the third column again C (notice the 5-unit word space before this C), and in the fourth column Q is generated. In the fifth column the word DE is programmed and so on. All these columns are connected to the individual input lines of the 74150 multiplexer.

The *74150 multiplexer* has 16 data-input lines, one output line, and 4 input addresses. If a 4-bit binary code is applied to its input address, then the data-input line which is the decimal equivalent of the applied binary input address will be connected to its output line. Suppose a binary code like 1000 is applied to its input address. Then data-input line 8 would be connected to its output line (pin 10 of the 74150 IC), and during this period, whatever data is fed to this input line would be made available at its output line (after an inversion, of course). To make it simpler, this multiplexer can be considered as a single-pole, 16-way (1P16W) bandswitch. As soon as the unit is switched on, the pole will be connected to its first "way" (bandswitch in position 1) and at the end of the 16th pulse (from the clock), this bandswitch receives a command through its input address to change its position from the first band to the second band. At the end of the 32nd pulse, this bandswitch moves to the third position and so on. At the 16th position, the bandswitch remains for a 16-pulse duration, then switches back to its first band position and the cycle repeats.

The output of this multiplexer will be a continuous stream of 0s and 1s. This output will then be applied to a switching transistor, SL100. For each 1 the relay will be actuated (holds) and for a 0 the relay will not operate. The relay contacts are used to key the transceiver (alternately, a switching transistor like 2N3696 could be used).

An improved CQ Sender with different modes and an increased memory (Fig. 3) will add either "DX" or "test" to the call and will repeat the callsign three times. The memory of the modified sender is doubled by the addition of a second 74150, a 7476, and an AND gate to create a 32-line-to-1-line multiplexer. This allows the callsign to be repeated three times, although it is programmed only once in the diode matrix.

A double-pole, three-way switch selects the message

to be sent. As it is programmed in Fig. 3, the enhanced CQ Sender will send "CQ" five times, "DE," and then "VU2ARC" three times if the switch is in position 1. In position 2, the message will be "CQ CQ DX CQ DX" with the same sign-off, and in position 3 the sender will emit "CQ CQ TEST CQ TEST," again adding the same ending. In all three modes, it will complete the transmission with AR K.

(In the prototype, the word QRZ was also included as the fourth mode. Later on, it was found not very important and hence it is not shown in Fig. 3.)

Conclusion

With the RC values shown for the clock oscillator, the generated Morse speed can be varied anywhere between 8 and 15 wpm. After calling "CQ CQ DE VU2ARC AR K" once, a pause of about 8 seconds (at 8 wpm) occurs before it starts calling the CQ message once again. During this 8-second gap the transceiver will be in the receive mode to receive a possible reply. The relay output (normally-open contacts) can be connected in parallel with a straight key or to an automatic keyer.

The power supply for this unit was designed using the 7805 3-terminal 5-V voltage-regulator IC.

The programming can be altered simply by rearranging the diode positions in the diode matrix.

The circuit was assembled on a PCB and housed in a ready-made slim metal box and was demonstrated at our club meeting and also at the BEL ARC exhibition held recently in Bangalore. The design was much appreciated by the engineers and by many senior hams like VU2GSM, VU2GZ, and VU2IR. ■

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Yasme and the Call of Abu Ail

It was just a speck in the Red Sea,
but it created pileups as big as a mountain.

Lloyd Colvin W6KG
Iris Colvin W6QL
Yasme Foundation
Box 2025
Castro Valley CA 94546

Yasme was the name of the boat on which a radio amateur named Danny Weil went forth in 1954 on a continuous worldwide trip devoted primarily to communication with other radio amateurs throughout the world. He was the first person in the world to make such an expedition. The Yasme Foundation was formed and, over the last two decades, nearly 100 Yasme DXpeditions to rare and semi-rare countries have been made with various operators participating.

This is the story of the December, 1982, Yasme DXpedition to Abu Ail, which is one of the rarest DX countries in the world. Preparations and correspondence pertaining to the trip were in the making for three years.

Abu Ail (with Jabal At Tair) is listed as a separate country by the ARRL. They are both islands with a lighthouse and people on them. Abu Ail is a 350-foot-high rock located in the Red Sea, on the major water route from the Indian Ocean through the Red Sea to the Suez Canal and on north to the Mediterranean. The island is well named (Arabian words meaning "Father Ail") because its lighthouse watches over and guides the many ships away from the rocks. None of them stop, and the lighthouse keeper stays there eight months at a time without leaving the lighthouse.

Abu Ail is an international island owned by no one nation. On a clear day, Ethiopia can be seen to the west and North Yeman to the east.

Permission was eventually obtained from the administrators of the islands, The Compagnie Maritime Auxiliare d'Outre-Mer in Djibouti—who are associated with Red Sea Lights of London—to visit the island and operate an amateur radio station there, thus making a DXpedition to Abu Ail possi-

Abu Ail and the cliff up which everything had to be carried.

Lloyd and Iris in the landing cove with a generator and some gasoline. The Fahnous is in the background.

ble. We have been going on Yasme DXpeditions for many years and did most of the planning of the trip up to this point. Additional help then was needed, and fortunately, two French amateurs, Christian Dumont FØECV and Jean Michel Gabouriaud F6GBQ, were recruited. (They are J28DP and J28DL in Djibouti.) They supplied generators and additional needed radio gear.

All four of us had to sign agreements that we and our heirs and assigns accepted full responsibility for any casualty or mishap that might occur. We agreed not to interfere with the functions of the lighthouse in any way whatsoever. We agreed to take with us anything that we needed in the way of food, water, generators, gasoline, and anything else that we might use.

Arrangements were made for passage on the *Fahnous* (Arabian word meaning "lamp"), the supply ship that services the island monthly with food, water, and supplies. We agreed to pay for our passage and for the diversion of the ship from its regular route, putting us ashore on Abu Ail, continuing on to Jabal At Tair, and then returning 48 hours later to pick us up. We fully understood that the ship could not remain anchored near the island and that we must be ready and waiting to board quickly when the ship arrived.

We made a list of essentials, keeping in mind that time was limited and that everything must be carried up the steep cliff. The list included food and water for 48 hours, sleeping bags, gifts for the lighthouse keeper, and our radio equipment, consisting of two generators (one 1.5 kW and one 500 Watts), gasoline, antennas, coax, a Yaesu 707, a Kenwood 520, a Yaesu 902DM transceiver, and a Heathkit 230 amplifier.

The good ship *Fahnous* left Djibouti with the four of us and our equipment aboard at about 3:00 pm on December 4, 1982. The seas were extremely high during the night but were somewhat calmer when we arrived at Abu Ail at 8:00 am the following morning. All of our equipment and ourselves had to be transferred from the ship to a small dinghy. The seas were still rough, and the dinghy was bouncing up and down alongside the ship as much as 6 feet with each wave. Both the loading of the dinghy and the landing ashore were dangerous and tricky. It would have been very easy to have lost our equipment or suffered injury ourselves. Fortunately, the only mishap was to the dinghy, which hit a reef during the landing, causing some damage to its side. After landing, we started the ascent up the cliff with our equipment, giving priority to the actual radio gear. The wind blew continuously, making the trek up even more difficult.

By about 10 am, G5ACI/AA was on the air, using the vertical antenna, the Yaesu 707, and the small generator. A little after noon, both stations were in operation. The four of us took turns operating for sessions of approximately two hours each. At the same time, work was continued to bring the rest of the supplies up the hill and to put up doublets for 40 meters and the new 30-meter band.

We encountered a number of minor setbacks and delays. The limited space at the top of the rock made it impossible to locate the two stations far enough apart for both to operate on some frequencies simultaneously without interference. The guys for the TH3 had to be located over the edge of the cliff, which slowed the process of erecting the beam. We also ran into some difficulties in getting either the Yaesu 707 or the Kenwood 520 on CW operation.

Jean F6GBQ (left) and Lloyd W6KG erecting an antenna on Abu Ail. It is 350' almost straight down to water behind them.

The crew at G5ACI/AA. Left to right, Jean Michel Gabouriaud F6GBQ, Christian Serge Dumont FØECV, Lloyd Colvin W6KG, and Iris Colvin W6QL.

All obstacles were eventually overcome. We stayed on the air continuously, operating on 5 bands, both phone and CW. We made contact with over 4000 amateurs in 105 different countries.

At about 6:00 am on the morning of December 7th, we sighted the *Fahnous* approaching. We began dismantling the stations and pulling down the antennas. We bid farewell to the lighthouse keeper, who said that our visit was an exciting change from his usual routine. The descent was somewhat easier and faster than the ascent. The gasoline had been used up, and any extra food was left behind.

As we boarded the *Fahnous*, we felt tired and exhausted—but we also were very happy over the successful completion of Operation Abu Ail.

A few observations and recommendations to anyone going on a similar DXpedition are listed:

1. Be sure that you obtain proper authorization and licensing, in writing, well in advance.

2. If possible, set up the complete operation, including all equipment (generators, etc.), at your home base before going on the DXpedition. We did this and discovered and corrected a number of time-consuming problems on the test run. These included how to solve problems of guying antennas, what interference we could expect to find, and what frequencies to use when simultaneously operating several stations close to each other. We found that we could operate a station on SSB and a station on CW simultaneously on the 10-meter band—but this could not be done on the other bands.

3. If you are going to climb a steep mountain carrying 50 to 80 pounds, figure out in advance the easiest way to do this. We found that the best thing was to reduce weight. Do not carry one pound of anything that is not required!

4. Try to think of everything in advance. We had small lights to use for nighttime operation, but we forgot to carry shades for the days. We had to waste some DXpedition time fabricating makeshift shades.

5. Don't forget to bring earphones—we almost did. With the noise from generators and two stations operating at once, the use of headphones was essential.

6. Remember to bring a soldering iron. Something will come up when it will be needed. We used ours on two occasions.

7. Figure out in advance how you are going to keep your logs. We were so anxious to get on the air that we got our log-keeping of the two stations a little mixed up at the start.

8. If you are going by sea, bring seasick pills and use them. We had the pills OK, but one of our operators thought that he wouldn't need them. He did.

9. If you have any equipment requiring batteries, bring along extras. Both of our keyers and one flashlight required battery changes.

We were very lucky as to the ability of our operators. All four operators carried their fair share of both the physical work and the operating. All operators were trained, experienced DXers, and the handling of the pileups was no major problem.

The Yasme Foundation and everyone connected with it wish to thank the DX operators of the world for the general courtesy they showed in standing by until they could work the rare country of Abu Ail. ■

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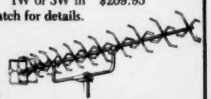

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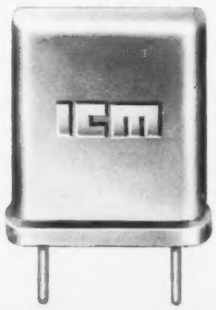

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SOCIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

MAPLE RIDGE BC CAN
JUL 2–3

The Maple Ridge ARC will hold its Hamfest '83 on July 2–3, 1983, at the Maple Ridge Fairgrounds, 30 miles east of Vancouver on Highway #7. The registration fee for hams is $5.00 and for non-hams over 12, $2.00. Features will include a swap and shop, bunny hunts, ladies' and children's programs, and displays. Food and lots of camper space (some with hydro) will be available. Talk-in on 146.20/.80 and 146.34/.94. For registration information (20% off for pre-registration), contact Bob Haughton VE7BZH, Box 292, Maple Ridge BC V2X 7G2, Canada.

SHELLSVILLE PA
JUL 4

The Harrisburg Radio Amateur Club will sponsor the annual Firecracker Hamfest on Monday, July 4, 1983, at the Shellsville VFW picnic grounds, Exit #27 (follow signs 2 miles to Shellsville), I-81, north of Harrisburg. Admission is $3.00, XYLs and children will be admitted free, and there will be no charge for tailgating. There will be plenty of parking, shade trees, tables, and a pavilion. Talk-in on .16/.76 or .52/.52 simplex. For additional details and table reservations, contact KA3HZW, 131 Livingston Street, Swatara PA 17113, or phone (717)-939-4957.

SPOKANE WA
JUL 8–10

The 5-state ARRL Northwestern Division Convention will be held on July 8–10, 1983, at the Spokane Convention Center, Spokane WA. The Spokane Swapfest (normally in April) will be combined this year with the convention as will be the flea market. Registration is $5.00 and swap tables are $10.00. Events will include displays by manufacturers and dealers, seminars on antennas, computers, VHF/EME, weather, traffic handling, and repeater operation. There will be ARRL and advisory committee forums. Ladies' programs will include a luncheon and style show. The Saturday-night banquet will feature Roy Neal, NBC news correspondent, and the Royal Order of the Wouff Hong ceremony will follow at midnight ($1 admission). The DX breakfast and church services will be on Sunday morning. Close-in RV parking is available. For additional information, write Northwest '83, PO Box 3933, Spokane WA 99220.

FARIBAULT MN
JUL 9

The Faribault Amateur Radio Club will hold its 2nd annual swapfest on Saturday, July 9, 1983, from 9:00 am to 3:00 pm, at the Rice County Fairgrounds on the north edge of Faribault MN. General admission is $1.50, admission and selling space is $3.00 (indoor or outdoor), and tables (7-foot and by pre-registration only) are $3.00 each. Lunch and free parking will be available. There will be amateur radio and computer gear as well as electronic equipment displayed. Talk-in on 146.19/.79. For more information, contact Donald Klier, 1118 NW 8th Street, Faribault MN 55021.

OAK CREEK WI
JUL 9

The South Milwaukee Amateur Radio Club will hold its annual swapfest on Saturday, July 9, 1983, from 7:00 am to approximately 5:00 pm, at the American Legion Post #434, 9327 South Shepard Avenue, Oak Creek WI. Admission is $3.00 per person and includes a "Happy Hour" with free beverages. Parking, a public picnic area, hot and cold sandwiches, and liquid refreshments will be available on the grounds. There will be free overnight camping. Talk-in on 146.94. For more details, including a local map, write South Milwaukee Amateur Radio Club, Inc., PO Box 102, South Milwaukee WI 53172-0102.

STATE COLLEGE PA
JUL 9

The Nittany Amateur Radio Club will hold a hamfest and computer fair on Saturday, July 9, 1983, beginning at 8:00 am, at the Pleasant Gap Firemen's Park, Route 144, Pleasant Gap PA (just off Route 26, east of State College). Tickets are $3.00; tailgating spaces are $5.00. Talk-in on 146.16/.76 and 146.25/.85. For further information, write Dave Buckwalter KC3CL, 1635 Circleville Road, State College PA 16801, or phone (814)-234-0759.

MILTON ONT CAN
JUL 9

The Burlington Amateur Radio Club, Inc., will host the ninth annual Ontario Hamfest on Saturday, July 9, 1983, at the Milton Fairgrounds. For more information, write Burlington Amateur Radio Club, Inc., PO Box 836, Burlington ONT L7R 3Y7, Canada.

CROSSVILLE TN
JUL 9–10

The Plateau Amateur Radio Club will hold the Crossville Hamfest on July 9–10, 1983, at the Cumberland County Community Complex, Highway 70 North, Crossville TN. Admission is $1.00 for adults. Exhibit and flea-market space will be available on a first-come basis. There will be a Dutch-treat dinner on Saturday night. Talk-in on 147.93/.33. For further information, contact the Plateau Amateur Radio Club, PO Box 2621, Crossville TN 38555.

ALEXANDER NY
JUL 10

The Genesee Radio Amateurs, Inc., will hold the ARRL-approved third annual Batavia Hamfest on Sunday, July 10, 1983, from 6:00 am to 5:00 pm, at the Alexander Firemen's Grounds, Rte. 98, Alexander NY (9 miles south of Batavia). Registration is $2.00 in advance and $3.00 at the gate. Features will include a large exhibit area, OM and YL programs, contests, a boat-anchor auction, and overnight camping. Food will be available. Talk-in on 6.52 or 4.71/5.31 (W2RCX). For more information or advance tickets (make checks payable to Batavia Hamfest), write c/o GRAM, PO Box 572, Batavia NY 14020.

INDIANAPOLIS IN
JUL 10

The Indiana State Amateur Radio Convention, in conjunction with the Indianapolis Hamfest and Computer Show, will be held on Sunday, July 10, 1983, at the Marion County Fairgrounds at the southeastern intersection of I-74 and I-465. Gate tickets are $4.00 and entitle you to all activities. There will be inside and outside flea markets, a separate computer show and flea market, a commercial vendor's display area, technical forums, club activities, ladies' activities, and professional food services. There will be setups after 12:00 noon on Saturday, July 9th. Security will be provided Saturday night and Sunday, and camper hookup facilities will be available on the grounds. For further information, contact Indianapolis Hamfest, Box 11066, Indianapolis IN 46201.

DOWNERS GROVE IL
JUL 10

The DuPage Amateur Radio Club Hamfest/Computerfest will be held on Sunday, July 10, 1983, from 9:00 am to 4:00 pm, at the American Legion Post grounds, Downers Grove IL. Tickets are $2.00 and will be available only at the gate. There will be food, drinks, and plenty of parking space, as well as a large outdoor flea market. Talk-in on 144.89/145.49. For more information, send an SASE to W9DUP, PO Box 71, Clarendon Hills IL 60514, or call (312)-971-1156.

MONTANA-ALBERTA CAN
JUL 15–17

The 49th Glacier-Waterton International Hamfest will be held on July 15–17, 1983, at Waterton Homestead Campground, just north of Waterton National Park entrance on Highway 6 (Alberta, Can.). There will be a bunny hunt, technical sessions, entertainment, and swap tables. For more information and pre-registration, write PO Box 148, Milk River, Alberta T0K 1M0, Can.

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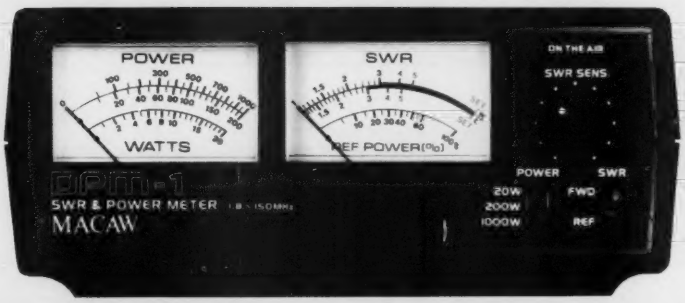

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CARY NY
JUL 16

The Cary Amateur Radio Club will hold its eleventh annual Mid-Summer Swapfest on Saturday, July 16, 1983, from 9:00 am to 3:00 pm, at the Lion's Club Shelter (next to Cary Senior High School), Cary NC. There is no admission or commission charge. Featured will be an open auction at 1:00 pm. Talk-in on 146.28/.88, 147.75/.15, and 146.52 simplex.

SHEBOYGAN WI
JUL 16

The annual Sheboygan County Amateur Radio Club Lakeshore Swapfest and Brat Fry will be held on July 16, 1983, from 10:00 am to 4:00 pm, at the Wilson Town Hall, south of Sheboygan WI. Tables are free and camping is available at Terry Andre State Park. There will also be a public auction. For a flyer and other information, write PO Box 895, Sheboygan WI 53081, or phone (414)-457-3203.

AUGUSTA NJ
JUL 16

The Sussex County Amateur Radio Club will hold its fifth annual hamfest, SCARC '83, on Saturday, July 16, 1983, at the Sussex County Farm and Horse Show grounds, Plains Road, off US Highway 206, Augusta NJ, just north of Newton. General registration is $2.00. There will be acres of free parking and outdoor flea-market space. Pre-registration for sellers is $4.00 ($5.00 at the gate). There will be a huge building for indoor sellers and pre-registration is $5.00 ($6.00 at the gate). Talk-in on 147.90/.30 and 146.52. For more information or registration, write Lloyd Buchholtz WA2LHX, 10 Black Oak Drive, RD 1, Vernon NJ 07462.

MANCHESTER NH
JUL 16

The New Hampshire FM Association will hold an electronics flea market on Saturday, July 16, 1983, beginning at 9:00 am, at the Manchester Municipal Airport. General admission is $1.00 per person (sellers, $5.00). Sellers should tailgate or bring their own table. Commercial displays are welcome. Refreshments will be available. Talk-in on 146.52 FM. For pre-registration, write NHFMA, Inc., 30 Meadowglen Drive, Manchester NH 03103. For further information, contact Dick DesRosiers W1KGZ at (603)-668-8880 or Doug Aiken K1WPM, 30 Meadowglen Drive, Manchester NH 03103, at (603)-622-0831.

EUGENE OR
JUL 16–17

The 8th annual Lane County Ham Fair will be held on July 16–17, 1983, at the Oregon National Guard Armory, 2515 Centennial, Eugene OR. Registration is $4.00 and swap tables are $5.00 each (2 maximum). Doors will open at 8:00 am both Saturday and Sunday and there will be a potluck supper at 6:00 pm on Saturday. Features will include a 2-meter bunny hunt, computer demos, technical seminars, swap tables, bingo, a Kiddie Korner, and women's activities. An all-day snack bar and free parking for RVs (no hookups) will be available. Talk-in on .52/.52, 146.28/.88, and 147.86/.26. For tickets or swap tables, send a check payable to Lane County Ham Fair to Tom Temby WB7WPU, Treasurer, 3227 Crocker Road, Eugene OR 97404, or phone (503)-689-1761.

PALMYRA IL
JUL 16–17

The Quad-Co. Amateur Radio Club will sponsor the 26th annual Hamfest of the Breakfast Club on July 16–17, 1983, at Terry Park, 3/4 mile east of Palmyra IL. Pre-registration until July 7, 1983, is $1.50 (at the gate $2.00). Camping facilities will be open from Friday afternoon until Monday morning. There will be games, contests, golfing, fishing, gear swapping, and on Saturday night, dancing and movies. Bring your own basket lunch; sandwiches and soft drinks will be available on the grounds. Talk-in on 3973 kHz from noon Saturday until 11:00 am Sunday. For more information, write Hamfest, c/o Quad-Co. ARC, 602-D East Walnut, Chatham IL 62629.

LAPORTE IN
JUL 17

The combined LaPorte-Michigan City Amateur Radio Clubs will hold their Summer Hamfest on Sunday, July 17, 1983, from 8:00 am to 2:00 pm, at the LaPorte County Fairgrounds, State Road 2, west of LaPorte IN. The donation is $3.00 at the gate. Good food, cold drinks, and paved outdoor parking will be available. For reservations for indoor tables (40¢/foot), write PO Box 30, LaPorte IN 46350.

EDGEWATER PARK NJ
JUL 17

The 5th annual West Jersey Radio Amateurs Hamfest will be held on Sunday, July 17, 1983, 9:00 am to 3:00 pm, rain or shine, at the Super 130 Drive-In Theatre, Route 130, Edgewater Park NJ (2 miles south of Burlington, 8 miles north of Palmyra). Registration is $3.00 and tailgating is $3.00 (sellers must bring their own tables). Early setup for vendors only is at 7:00 am. Talk-in on 147.75/.15, 144.87/.47, and 146.52. For further information or to order tickets, send an SASE to Mary Lou Shontz N2CLX, 107 Spruce Lane, Route 16, Mount Holly NJ 08060, or phone (609)-267-3063.

CANTON OH
JUL 17

The Tusco ARC (W8ZX) and the Canton ARC (W8AL) will present the 9th annual Hall of Fame Hamfest on Sunday, July 17, 1983, at the Nimishillen Grange, 6461 Easton Street, Louisville OH. Tickets are $2.50 in advance, $3.00 at the gate, and children under 16 will be admitted free. Flea-market parking is $2.00 and tables are available on a reserved basis at $3.50 each. A check must accompany reservations. There will be forums, dealers, a flea market, food, and XYL activities. Talk-in on 146.52 and 147.72/.12. For reservations or more information, contact Butch Lebold WA8SHP, 10877 Hazelview Avenue, Alliance OH, or phone (216)-821-8794.

BOWLING GREEN OH
JUL 17

The 19th annual Wood County Ham-A-Rama will be held on Sunday, July 17, 1983, beginning at 8:00 am, at the Wood County Fairgrounds, Bowling Green OH. Admission and parking are free. Trunk sales and food will be available. Advance table rentals are $5.00 and are for dealers only. Saturday will be available for setups until 8:00 pm. Talk-in on .52. For more information or dealer rentals, send an SASE to Wood County ARC, c/o Craig Henderson, Box 366, Luckey OH 43443.

POUGHKEEPSIE NY
JUL 23

The Mt. Beacon Amateur Radio Club will hold its annual ARRL hamfest on July 23, 1983, from 8:00 am to 3:00 pm, at the Arlington Senior High School, Poughkeepsie/Lagrange, Dutchess County NY. Admission is $2.00 (XYL and your children will be admitted free), tailgating space is $3.00 (includes one free admission), and a table space is $4.00 (includes one free table and admission). Hot food, beverages, and free parking will be available. There will be an auction beginning at 2:00 pm. Talk-in on 146.37/.97 and 146.52. For additional information, write Art Holmes WA2TIF, 2 Straub Drive, Pleasant Valley NY 12569, (914)-635-2614, or Walt Sutkowski K2DPL, W. Redoubt Road, Fishkill NY 12524, (914)-897-5158.

GLENWOOD SPRINGS CO
JUL 23

The Ski Country Amateur Radio Club will hold its second annual swapfest on July 23, 1983, at Colorado Mountain College, 1402 Blake Avenue, Glenwood Springs CO. There is no admission charge. Tables are $5.00 each. Talk-in .07/.67. For further information, contact Frank WA0BBI, Box 280, El Jebel CO 81628.

WELLINGTON OH
JUL 23

The Northern Ohio Amateur Radio Society will hold NOARSFEST on Saturday, July 23, 1983, from 8:00 am to 5:00 pm, at the Lorain County Fairgrounds, Route 18, 1/2 mile west of Route 58, Wellington OH. Donations are $2.50 in advance and $3.50 at the gate. Children under 12 will be admitted free. Parking for the flea market is $1.00 per car space. Flea-market setup is from 6:00 am to 8:00 am. Plenty of free parking will be available in a large general parking area. Indoor exhibit spaces with an 8-foot table are $8.00 each. Send check for advance registration to Don Winner WD8RZG, 8927 Torrance Avenue, Brooklyn OH 44144, or phone (216)-749-6594. There will be refreshments and 807s will be furnished by NOARS. Campers may park overnight Friday at no charge but no hookups will be available. Talk-in on 146.52/.52 (K8KRG) and 144.55/145.15. For admission tickets, write NOARSFEST, PO Box 354, Lorain OH 44052.

SEATTLE WA
JUL 29–31

The Western Washington DX Club (W7FR) will host the 31st annual Northwest DX Convention on Friday, Saturday, and Sunday, July 29–31, 1983, at the Double Tree Plaza Hotel, located near the South Center Shopping Mall and the Seattle-Tacoma Airport. There will be a Saturday night banquet and a Sunday morning breakfast, as well as speakers, slides, symposia, and awards. Talk-in on 146.40/147.00 (W7FR). For registration, contact Ruth Bennett WA7RVA, 6729 Beach Drive SW, Seattle WA 98116, or phone (206)-932-1335. For further information, contact WA7RVA or Roy Foote N7AIF, Chairman, 3029 48th Avenue SW, Seattle WA 98116, or phone (206)-935-8041.

OKLAHOMA CITY OK
JUL 29–31

The Central Oklahoma Radio Amateurs will hold the ARRL State Convention at Ham Holiday '83 on July 29–31, 1983, at the Myriad Convention Center, Oklahoma City OK. Pre-registration is $6.00 ($7.00 at the door). Children age 12 and under will be admitted free with a parent. Every pre-registrant may buy one flea-market table for $1.00. In addition to the noncommercial flea market, there will be displays, forums, programs, special group meetings, and a buffet and dance on Saturday night. Ample parking will be available and hotel accommodations with special Ham Holiday rates are nearby. For further information or pre-registration forms, write CORA, PO Box 14268, Oklahoma City OK 73113.

CUMBERLAND ME
JUL 30

The Blackstrap Repeater Association will hold the second annual Greater New England Hamfest on Saturday, July 30, 1983, from 8:00 am to 5:00 pm, at Cumberland Fairgrounds, Cumberland ME. Tickets are $1.00 in advance and $2.00 at the gate. There will be forums, exhibits, meetings, speakers, dealers, and a giant flea market. Food and free camping will be available. Talk-in on 147.69/.09, 146.52, 3.940, and 146.13/.73. For more information, call Ed Williams KA1FZD at (207)-846-3509.

ISHPEMING MI
JUL 30

The Hiawatha Amateur Radio Association of Marquette County, in celebration of its 50th anniversary, will sponsor the 35th annual Upper Peninsula Hamfest on July 30, 1983, from 9:00 am to 5:00 pm, at the Michigan National Guard Armory in Ishpeming. Registration is $1.00 and tables will be available for $3.00 each. Features will include a computer demonstration and net meetings. Talk-in on 146.16/.76. For more information, contact George Lehtinen W8IOC, 100 N. Daisy, R2, Ishpeming MI 49849, or phone (906)-485-5038.

ASHEVILLE NC
JUL 30–31

The Western Carolina Amateur Radio Society will sponsor the WCARS Hamfest and Computer Fair of 1983 on July 30–31,

HAM HELP

I need the schematic and circuit data for the Comdel speech processor.

J. T. Maloney W2BE
152 Hawkins Rd.
Centereach NY 11720

Could someone provide me with QSL information for 9J2DS and TYA11?

Rick Todd N8CWX/DU2
PSC #2 Box 12956
APO San Francisco CA 96311

I am looking for the schematic for an SBE Touch-Com 40.

Lisle T. Hines K2QLA
4 Ellwood Ave.
Cortland NY 13045

I need a source for a 1N23B diode used in a General Radio Slotted Line 874.

Rudolf E. Six KA8OBL
30725 Tennessee
Roseville MI 48066

1983, beginning at 9:00 am, at the Buncombe County Fireman's Training Center, Asheville NC. Features will include an ARRL booth and seminar by Bob Grove WA4PYQ, McElroy Memorial CW competition, a flea market, bingo, RV parking and free camping (no hookups), and computer hardware and software. Talk-in on .31/.91, .61/.76, and .52 simplex. For ticket information, write Garland Lance NC4N, 854 Sandhill Road, Asheville NC 28806.

OLIVER BC CAN
JUL 30–31

The Okanagan International Hamfest will be held on July 30–31, 1983, at Oliver Centennial Park, Oliver BC. Registration will be at 9:00 am (PDT) on Saturday, July 30th and the activities will be from 1:00 pm on Saturday through 2:30 pm on Sunday. YLs may bring crafts, hobbies, and flea-market items for sale or display. There will be a potluck luncheon on Sunday, as well as entertainment and bunny hunts. Talk-in on the .34/.94 repeater or .76/.76. For further information (no advance reservations), write John Juul-Andersen VE7DTX, 8802 Lakeview Drive, Vernon BC V1B 1W3 or Lota Harvey VE7DKL, 584 Heather Road, Penticton BC V2A 1W8.

ALEXANDRIA LA
JUL 30–31

The Central Louisiana Amateur Radio Club will hold a hamfest on Saturday and Sunday, July 30–31, 1983, at the Bolton Avenue Community Center, Alexandria LA. Swap tables will be available.

BELVIDERE IL
JUL 31

The Belvidere Amateur Radio Association will hold its annual hamfest on July 31, 1983, at the Boone County Fairgrounds, Route 76, Belvidere IL. Admission is $2.00 in advance and $2.50 at the door. Tables may be reserved for $2.00. There will be plenty of free flea-market spaces and, if it rains, there will be inside space available. There will be camping on Saturday night. Talk-in on 146.52. For more information, contact Bob Anderson K9DCG, 910 Locust Street, Belvidere IL 61008.

CENTREVILLE MI
JUL 31

The Amateur Radio Public Service Association of Saint Joseph County MI will hold its 5th annual swap and shop on Sunday, July 31, 1983, at the Saint Joseph County Fairgrounds, Centreville MI. Doors will open at 8:00 am. Tickets are $2.00 in advance and $3.00 at the gate. Indoor tables are $3.00; trunk sales are free. Camping will be available on Saturday night only for $6.00. Talk-in on .52. For more information, contact Warren Harder N8EOX, 14820 Broadway Road, Three Rivers MI 49093.

JACKSON WY
AUG 5–7

The 1983 ARRL Rocky Mountain Division Convention, in conjunction with the 51st WIMU Hamfest, will be held on August 5–7, 1983, at the Virginian Motel, Jackson WY. Talk-in on 146.22/.82 and .3923 kHz. For reservations, call the Virginian at (307)-733-2792. For more information, phone R. L. "Pete" Stull WB7AMP at (307)-382-9032 or Dave Gregory N7COA at (307)-875-5324.

MOBERLY MO
AUG 7

The NEMO ARC of Kirksville MO and the Tri-County ARC of Moberly MO will hold the 5th annual North Missouri Hamfest on Sunday, August 7, 1983, at the Moberly Municipal Auditorium, Moberly MO. The auditorium has 12,000 square feet of air-conditioned space for the inside flea market and there will be a limited number of tables available free. Tickets are $1.50 in advance or $2.50 at the door. Doors will open for the flea market and distributors beginning at 8:00 am and for the hamfest, from 9:00 am until 3:00 pm. There will be forums, films, sandwiches, and drinks, as well as donuts and coffee for the early birds. Talk-in on 147.69/.09. For more information and/or tickets, contact Sam Fischer KA0ILO, PO Box 341, Moberly MO 65270.

ANGOLA IN
AUG 7

The Steuben County Radio Amateurs will hold their 25th annual FM Picnic and Hamfest on Sunday, August 7, 1983, at Crooked Lake, Angola IN. Admission is $2.50. Features will include picnic-style BBQ chicken, inside tables for exhibitors and vendors, a large electronics flea market, and overnight camping (fee charged by county park). Talk-in on 146.52 and 147.81/.21.

AUSTIN TX
AUG 12–14

The Austin Amateur Radio Club and the Austin Repeater Organization will sponsor Austin Summerfest '83 on August 12–14, 1983, at the Austin Marriott Hotel, Interstate 35 at Highway 290. Admission is $5.00 in advance and $6.00 at the door. Swapfest tables are available on a first-come, first-served basis, but each seller may also reserve one table in advance for $1.00. Summerfest '83 will combine the Texas VHF-FM Society Convention with forums, meetings, an indoor swapfest, dealer exhibits, and many outside activities for the family at Austin's annual Aqua Festival. Talk-in on 146.34/.94. For more information, write Austin Summerfest '83, PO Box 13473, Austin TX 78711.

DUNKIRK NY
AUG 13

The Lake Erie International Hamfest Association will hold its fifth annual Lake Erie International Hamfest on Saturday, August 13, 1983, beginning at 8:00 am, at the Chautauqua County Fairgrounds, Dunkirk NY. Admission is $2.50 in advance and $3.00 at the gate. Each flea-market space is $1.00 plus admission. There will be indoor dealer exhibits as well as a large flea market. Talk-in on 146.25/.85 and 146.52. For more information, write Lake Erie International Hamfest, PO Box 455, Dunkirk NY 14048.

POMONA CA
AUG 13

The Tri-County Amateur Radio Association will sponsor the TCARA 13th Annual Hamfest and Picnic on Saturday, August 13, 1983, from 8:00 am to 2:00 pm, at the Los Angeles County Fairgrounds in Pomona CA. Tables will be available for ham/computer exhibits and displays. There will be sandwiches and soft drinks available. For more information, contact Tony Skvarek W6ELZ, 1514 W. Mission #14, Pomona CA 91766.

BURLINGTON VT
AUG 13–14

The Burlington Amateur Radio Club will hold its annual International Hamfest and Flea Market on August 13–14, 1983, at the Old Lantern Campgrounds, Charlotte VT. For both days, tickets are $4.00, outdoor flea-market spaces are $2.00, and indoor spaces are $5.00. Food and drink will be available. Talk-in on .34/.94, .01/.61, and .52 simplex. For further information, contact Frank W1CTM, Burlington Amateur Radio Club, PO Box 312, Burlington VT 05402.

WILLOW SPRINGS IL
AUG 14

The Hamfesters Radio Club, Inc., will hold their 49th annual hamfest and picnic on Sunday, August 14, 1983, at Santa Fe Park, 91st and Wolf Road, Willow Springs IL (southwest of Chicago). Tickets are $2.00 in advance and $3.00 at the gate. Featured will be the famous swappers' row. There will be exhibits for OMs and XYLs. For advance tickets, send a check or money order and an SASE to Hamfesters, PO Box 42792, Chicago IL 60642.

FCC

10-YEAR LICENSES

Hoping to save both time and money, the FCC has proposed that the length of amateur licenses be extended to 10 years, with a 2-year grace period for renewing expired licenses. In its comments, the Commission noted that license renewals, which were up to 36,000 in 1982, would be reduced to about 12,000 per year. In addition, the number of licenses which are allowed to lapse inadvertently would decrease, according to the FCC.

Here is the Commission's proposed Part 97 amendment, as it appeared in the *Federal Register*:

PART 97—[AMENDED]

Appendix

It is propsed to amend Part 97 of the Commission Rules, 47 CFR Part 97, as follows:

1. In § 97.13, paragraph (d) would be revised to read as follows:

§ 97.13 Renewal or modification of operator license.

* * * * *

(d) If a license is allowed to expire, application for renewal may be made during a period of grace of two years after the expiration date. During this two year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of its expiration. Application for renewal shall be submitted on FCC Form 610 and shall be accompanied by the applicant's expired license.

(2) In Section 97.47, paragraph (b) would be revised to read as follows:

§ 97.47 Renewal and/or modification of amateur station license.

* * * * *

(b) If a license is allowed to expire, application for renewal may be made during a period of grace of two years after the expiration date. During this two year period of grace, an expired license is not valid. A license renewed during the grace period will be dated currently and will not be backdated to the date of expiration. An application for an individual station license shall be submitted on FCC Form 610. An application for an amateur club or military recreation station license shall be submitted on FCC Form 610–B. In every case the application shall be accompanied by the applicant's expired license or a photocopy therof.

(3) In Section 97.59, paragraphs (a) and (b) would be revised to read as follows:

§ 97.59 License term.

(a) Amateur operator licenses are normally valid for a period of ten years from the date of issuance of a new, modified or renewed license.

(b) Amateur station licenses are normally valid for a period of ten years from the date of issuance of a new, modified or renewed license. All amateur station licenses, regardless of when issued, will expire on the same date as the licensee's amateur operator license.

20M PHONE EXPANSION

After a three-year battle, the 20-meter phone-band expansion went into effect on May 22. The new frequency allocation gave General-class operators use of the frequencies between 14.225 MHz and 14.275 MHz. Advanced-class licensees have phone privileges between 14.175 and 14.225 MHz, and Extra-class ticket holders are allowed to operate phone from 14.150 to 14.175 MHz. The Commission's amendments to Part 97, as published in the *Federal Register*, are shown below.

PART 97—[AMENDED]

Part 97 of the Commission's Rules and Regulations, 47 CFR Part 97, is amended as follows:

1. In § 97.7, paragraph (a) is revised to read as follows:

§ 97.7 Privileges of operator licenses.

(a) Amateur Extra and Advanced Class. All authorized amateur privileges including exclusive frequency operating authority in accordance with the following table:

Frequencies	Class of license authorized
3500–3525 kHz	Amateur extra only.
3775–3800 kHz	Do.
7000–7025 kHz	Do.
14,000–14,025 kHz	Do.
14,150–14,175 kHz	Do.
21,000–21,025 kHz	Do.
21,250–21,270 kHz	Do.
3500–3800 kHz	Amateur extra and advanced.
7150–7225 kHz	Do.
14,175–14,225 kHz	Do.
21,270–21,350 kHz	Do.

* * * * *

§ 97.61 [Amended]

2. In § 97.61, in the table in paragraph (a), the row beginning with "14000–14200 (kHz)" is revised by beginning the row with "14000–14150 (kHz)" so that the entire row reads as follows:

14000–14150 ..... F1

3. Also in § 97.61, in the table in paragraph (a), the row beginning with "14200–14350 (kHz)" is revised by beginning the row with "14150–14350 (kHz)" so that the entire row reads as follows:

14150–14350 ..... A3, A4, A5, F3, F4, F5

LETTERS

E.T. FEEDBACK

My wife and I both enjoyed the article on "How E.T. Really Called Home." When we saw the movie and Elliott and E.T. set the communicator up, I said, "That looks like something a ham would build." Looks like I was right!

Stephen Wimmer WB0GGT
Raymond NE

THE ELITE MODE

The solution to the question of code or no code can be answered to the satisfaction of everyone. The proponents of code offer the ability to "get through with CW when voice is unintelligible," narrower bandwidth, etc., as proof that CW is the ultimate skill that everyone should have as their goal. The thing I don't understand is, if CW is so damned good, why isn't it reserved for the select group that can master it and that have the technical expertise necessary to pass the Advanced- and Extra-class tests?

Instead of reserving CW for those who are most deserving of its fantastic benefits, the CW proponents prefer restricting those least deserving of its benefits to using only CW.

It just plain seems backwards. What needs to be done is to restrict Novices and Techs to voice until they've earned the right to use the far superior method of communicating, namely CW. Under this system, the highest class licensees would be able to use the best possible means of communicating, up to and including CW, while the lower class licensees would be restricted to the less efficient methods, i.e., voice.

What could be simpler or fairer? People who can't master or have no interest in mastering CW wouldn't be saddled with it while those who do enjoy it would have the added satisfaction of having the "best," to some extent, reserved for them.

James Delton N7ECC
Tempe AZ

Troublemaker.—Wayne.

FOR VIETNAM VETS

An open letter to all veterans of the US military during the Vietnam era who are now amateur radio operators:

We are trying to form a net of radio operators for each state to participate in communication with each other and with the nonprofit organization, Vietnam Veterans of America. Our objective is to reach all the vets of that era and band together for the purpose of brotherhood, benefits, and discussion of the effects of chemical warfare on us.

We will be publishing a newsletter and participating in the First Annual Convention for the Vets of the Era, in Washington, DC, on November 7–10. If you are interested in participating, contact Mike Kelly, 2101 Crescent Avenue, Eau Claire WI 54701, (715)-834-1738, or Larry Mittman N9AUG, Box 158, Rt. 5, Eau Claire WI 54701, (715)-874-6473.

Vietnam Veterans of America is a nonprofit combat veterans organization certified by the Congress of the United States.

Mike Kelly
Eau Claire WI

GUEST SPEAKER

You mentioned in the December, 1982, issue the woeful lack of good speakers at hamfests. I would like to offer my services to any interested hamfest/radio club. I am the Kentucky state coordinator for the Radio Amateur Satellite Corporation (AMSAT), and I have been active in amateur satellite communication for five years. I have a set of slides and I have a simple non-technical program which will explain the past, present, and future of amateur space activity. I also served a stint as technical editor of *73*, and I can talk about what it's like to work for the best magazine in amateur radio. If your club has any aspiring authors, I can tell you what makes an article worth buying.

I will travel anywhere there is a hamfest or club meeting. The only fee that I require is my travel expenses. I have access to a private plane so I can go anywhere in the eastern USA.

Charles E. Martin AB4Y
Box 3370
Bowling Green KY 42101

BEACON UPDATE

Here is an update on ten-meter beacons for the readers of *73*. The KA1YE/B beacon in southeastern Connecticut has been joined by at least two others in the US. They are: WA1IOB/B in the Boston area on 28.208 MHz, and W3VD/B in Laurel, Maryland, on 28.295 MHz. I haven't heard the IOB beacon here, but W3VD/B can be heard on backscatter.

Reception of the KA1YE and WA1IOB beacons has been reported in Great Britain in *Practical Wireless* magazine. In the May, 1983, issue there is a listing of 19 beacons worldwide with a graph displaying dates of reception in the UK. The beacons are from all continents, with VE2TEN being the only other North American beacon listed.

A listing of active beacons is being maintained by Willi HB9AVE. I have sent him the information on my beacon, and he would appreciate information from other individuals and groups operating ten-meter beacons. There is a limited amount of space allocated for unattended operation of beacons on ten meters here in the US, so some prior listening and coordination is highly recommended before putting on a beacon. This also holds for other bands.

I am willing to act as a clearinghouse for US beacons, keeping a file on activities and other information. If anyone is planning to put a beacon on ten, or knows of any other beacons active or planned, I would appreciate hearing about them. Please drop me a line. Thanks very much.

W. Keith Hibbert KA1YE
25 Hillcrest Road
Niantic CT 06357

BEST MAG

Your editorial and technical construction material is the best. I just renewed for two more years!

Russ Tower K1DOW
Arcadia FL

A DREAM COME TRUE

On March 30, 1983, I walked into the FCC field office at Syracuse, New York, with a Technician-class license. I walked out with a General-class interim permit. That permit is a dream come true and it has been a 27-year wait.

The reasons why I passed the code test were that I studied the code each day and I used your "Back Breaker" (CT7313) code tape. After two previous failures of the code test, I decided to use your tape. So, thank you very much for the help. Please keep up the good work at *73*.

(Re no-code licensing: I'm dead against it.)

Ben Alabastro WA2PXR
Frankfort NY

Right on there, Ben. If you and I have to suffer, then why shouldn't everyone? And think of the money I'll lose if they pass a no-code license and my code tapes stop selling. That 13-per tape is a rough one. . . I made that almost impossible so that you'd have clear sailing once you mastered it.—Wayne.

MODEM MAGIC

You're always interested in new technical ideas, so here's one you can think about. How about using our standard computer modems over the air and standardizing on these shift frequencies for computer-to-computer communications?

A modem for the VIC-20 is about $100, while commercial RTTY modems start at $150. The phone-line (Bell 103) modems use frequencies of 1070/1270 and 2025/2225 Hz. We could standardize on the lower two frequencies, since they're easily passed by receivers and transmitters, and the 200-Hz shift is within the FCC limits.

The only difficulty is that we'd have to shift the modems from the ORIGINATE position during transmit to the ANSWER position during receive. A relay could do this, and it seems to be a small price to pay to get one modem to serve double duty.

Anyone interested in giving it a try?

Jonathan A. Titus KA4QVK
Blacksburg VA

Hey! Do it and write an article! And you people in Nashua NH, you write one, too!—Wayne.

MULTI-BAND SLOPERS
160, 80, and 40 meters

Outstanding DX performance of slopers is well known. Now you can enjoy 2 or 3 band BIG-SIGNAL reports! Automatic bandswitching • Very low SWR • Coax feed • 2kw power • Compact • Ground or tower feed • Hang from any support 25 ft. high or higher • Easy to install • Very low profile • Complete instructions • Immediate shipment • Check ok

3 BAND SLOPER- 160, 80, & 40 Meters- 60 ft. long	$ 43.00 frt.ppd
2 BAND SLOPER- 80 & 40 Meters - 41 ft. long	$ 30.00 frt.ppd.
3-BAND NO TRAP DIPOLE, 160, 80, & 40M - 113 ft. long	$ 66.00 frt.ppd.
2-BAND NO TRAP DIPOLE, 80,& 40M - 84 ft. long	$ 49.00 frt.ppd.
FOR ADDN'L INFO on these and other unique antennas:	send SASE

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BOX 393-S MT. PROSPECT, IL 60056

. . . at last . . .
your shack organized!
A beautiful piece of furniture — your XYL will love it!
$184.50 S-F RADIO DESK
Deluxe - Ready to Assemble

Designed with **angled** rear shelf for your viewing comfort and ease of operation.

FINISHES: Walnut or Teak Stain.
Floor Space: 39" Wide by 30" Deep
Additional Information on Request.
Checks, Money Orders, BankAmericard and Master Charge Accepted.
F.O.B. Culver City. (In Calif. Add 6% Sales Tax.)
DEALER INQUIRIES INVITED

Also Available . . . .
Floor Space: 51" Wide by 30" Deep
$199.50

S-F

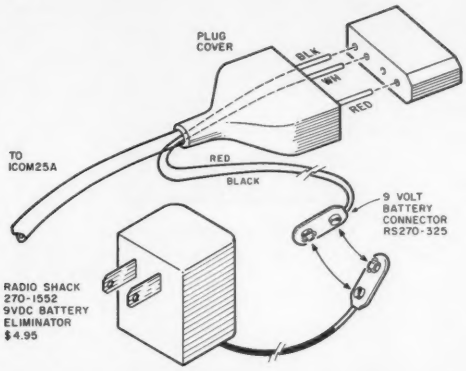
65

S-F Amateur Radio Services
4384 KEYSTONE AVENUE • CULVER CITY, CALIF. 90230 — PHONE (213) 837-4870

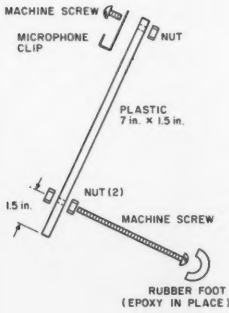
CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73 Magazine, Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



MEMORY BACKUP FOR THE ICOM 25A: To retain the memory in the Icom 25A when the power is disconnected, slip back the cover of the power plug and wire a 9-V battery connector to the white (positive) and black (negative) leads. When removing the rig from its power source, snap on a 9-V transistor battery or connect it to a plug-in transformer—Paul Van Bolhuis W4ZBD, Bradenton FL.



MICROPHONE HOLDER FOR MOBILE RIGS: Keep your operating area organized and neat when you are using a mobile rig as a base station. This holder will keep your microphone within easy reach yet out of the way, and the parts for it can be found in almost any junk box.—Thomas Hart AD1B, Westwood MA.

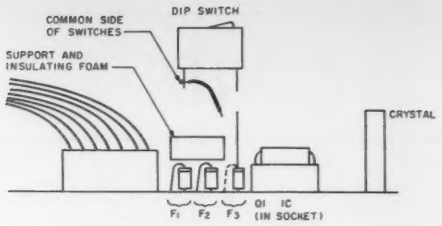


Fig. 1. Side view

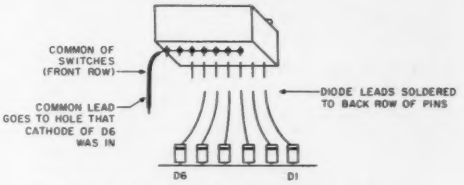
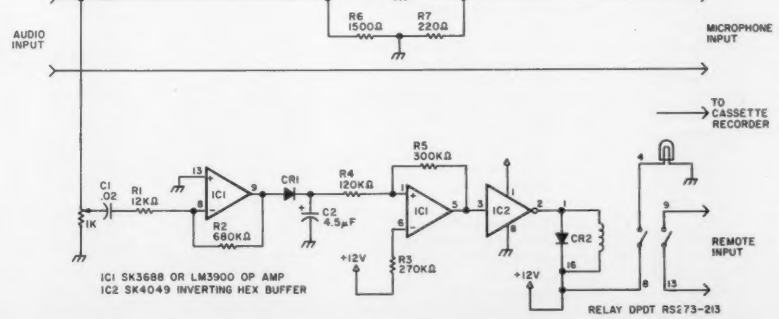

COMMON OF SWITCHES (FRONT ROW)
COMMON LEAD GOES TO HOLE THAT CATHODE OF D6 WAS IN
DIODE LEADS SOLDERED TO BACK ROW OF PINS
D6
D1

Fig. 2. End view (parts omitted for clarity).

SWITCH-SELECTABLE TONES FOR THE KENWOOD 7950/7930: The TU-79 tone unit for the Kenwood 7950/7930 provides for the selection of 3 preprogrammed tones from the keyboard. With the following modification, the third frequency may be programmed by setting a DIP switch rather than cutting or soldering diodes. First, program the tones for F1 and F2 and verify that they work. Unsolder the cathode leads of the diodes in row F3 and position them as shown in the diagrams. Then mount a piece of stiff insulating foam over the diodes in rows F1 and F2, securing it firmly in place. Orient a 6- or 7-position rocker-type DIP switch so that the pole numbers align with the diode numbers 1 through 6 on the PC board. Solder a common wire to all of the leads on one side of the switch as shown in Fig. 1. Solder diode leads 1 through 6 to the corresponding switch pins; solder the common wire to the hole which previously held the cathode wire from D6. Be careful when making the modification; on my instruction sheet, diodes D1 through D6 were shown in reverse order, but the markings on the PC board were correct.—Clint Williams KB8SY, Portage MI.

EASY COAX CONNECTIONS: Much time and effort can be saved when working with large-diameter coax such as RG-8/U by using a small, inexpensive tubing cutter to help with the stripping. These cutters can be obtained at most local hardware stores and are listed as ⅛- to ⅝-inch copper tubing cutters. Use the cutter to score the jacket of the coax and then simply peel off the jacket. This eliminates the nicked and damaged braid that often accompanies coax work. When the jacket has been removed and the braid exposed, use a soldering gun or high-wattage iron to quickly tin the braid in place. Now, use the tubing cutter to cut through the rigid braid just as if it were tubing. Cut deep enough to remove the braid but do not damage the inner insulation. The inner insulation can also be cut with the tubing cutter but I find it easier just to use a knife at this point. The resulting job is very neat, virtually guarantees no nicks, and makes it very easy to attach a PL-259 connector since the braid is already tinned.—Craig Crichton K7UKW, The Dalles OR.



AUTOMATIC TAPE RECORDING: Don't miss the action while you're away from the rig. This circuit turns on a tape recorder whenever the receiver's squelch is broken. After signal loss, the recorder will shut off following a slight delay.—Gary Anderson KE7H, Nampa ID.

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

VENEZUELAN WORLDWIDE CONTEST

SSB—Starts: 0000 GMT July 2
Ends: 2400 GMT July 3

CW—Starts: 0000 GMT July 30
Ends 2400 GMT July 31

The Radio Club of Venezuela invites all amateurs to paticipate in the 21st year of the Venezuelan Independence Worldwide Contest. Use all bands, 80 through 10 meters. Operating classes include: single operator, one band (for each band); single operator, multi-band; multi-operator, multi-band, one transmitter; and multi-operator, multi-band, multi-transmitter.

EXCHANGE:

RS(T) plus a three-digit QSO number starting with 001.

SCORING:

Contacts between stations of different countries count two points. Contacts with stations within one's own country do not count but are valid as multipliers for each band. Count one multiplier for each Venezuelan and USA call area and each country (including own) worked on each band. Use the ARRL DXCC country list. Final score is the total QSO points times the total multiplier points.

AWARDS:

For stations outside Venezuela there will be a plaque presented to the highest scorer in each class. Medals go to the highest scorer in each continent and among the Bolivarian countries (Bolivia, Columbia, Ecuador, Panama, and Peru) in the single-operator, multi-band class. Certificates to all stations in the Americas working 15 YV stations and 10 different countries, all European and African stations working 10 YV stations and 10 different countries, and all Asia and Oceania stations working 5 YV stations and 10 different countries.

ENTRIES:

Logs must show date and time in GMT, station worked, reports exchanged and respective numerical order, multipliers, and points. Use different sheets for each band worked. Include a separate summary sheet showing name(s) of operator(s), callsign, and address. Each participant must include $2.00 US or IRC equivalent with their logs. Entries must be postmarked no later than August 15 for SSB and September 15 for CW and should be addressed to: RCV, PO Box 2285, Caracas 1010-A, Venezuela.

INTERNATIONAL WORLDWIDE DX SSTV CONTEST

Starts: 0000 GMT July 15
Ends: 2400 GMT July 17

This is the third annual DX SSTV contest sponsored by *A5 Magazine*. It is a 48-hour SSTV video contest using 80 thourgh 10 meters within the recommended SSTV calling/operating frequencies listed below. To encourage allband contest usage and promotion, extra bonus points are granted on the 10-, 15-, 40-, and 80-meter band segments. Single- and multi-operator stations are recognized with crossband contacts not permitted. Individual contacts count only once per band with repetitive multiband contacts acceptable.

Barring any unforeseen changes from last year's rules, callsigns and video reports must be in "video" form. Mugshots of the station operator, family, or friends can count only once. Slower clock-rate speeds are encouraged in either 128/16.5- or 256/31-second time bases. Color work must contain a minimum of a 2-color overlay to qualify with standard RGB frame transmissions. Motion SSTV must have a minimum of 2 frames sent with automatic receive switching circuitry or manually operated switching by the receiving operator and 64 × 64 "quadrant" storage of no less than 4 separate pictures with replays.

SCORING:

Each SSTV two-way contact is worth 5 points within the same country, 10 points for DX out of country. Contact bonus points are available as follows: Mugshots—1 point, slow speed—2 points, quad frame—3 points, motion SSTV—4 points, high resolution—5 points, and color SSTV (RGB)—10 points. A band multiplier of 3 can be claimed for contacts on 40 and 80 meters, 2 for contacts on 6, 10, and 15 meters. Stations with over 25 DX countries worked add 25 points, over 50 DX countries add 50 points, over 100 countries add 100 points!

FREQUENCIES:

Advanced/Extra—3845, 7220, 14230, 21340, 28680, 50.150.

General—3990, 7290, 14340, 21440, 28680, 50.150.

AWARDS:

First-place winner receives a 3-year subscription (worth $60) to *A5 ATV Magazine* with front-cover picture plus a gold certificate. Second- and third-place winners receive one-year subscriptions and gold certificates. All entries regardless of score receive gold certificates suitable for framing. Results will be in the November issue of *A5 ATV Magazine*.

ENTRIES:

Submission of logs and totaled scores must be postmarked no later than August 1 and submitted to: Contest Manager, *A5 ATV Magazine*, PO Box H, Lowden IA 52255-0408. Logs will be returned as will any photos, etc. Some log sheets and DX country lists are available from WB0QCD.

CALENDAR

Jul 2-3	**Venezuelan Worldwide Contest—SSB**
Jul 9-10	**IARU Radiosport Championship**
Jul 15-17	***A5 Magazine* SSTV DX Contest**
Jul 23-24	**Brothers and Sisters QSO Party**
Jul 30-31	**Venezuelan Worldwide Contest—CW**
Jul 30-Aug 1	**Armadillo Run**
Jul 30-Aug 1	**CW County-Hunter's Contest**
Aug 6-7	**ARRL UHF Contest**
Aug 19-21	***A5 Magazine* UHF FSTV DX Contest**
Aug 20-21	**SARTG Worldwide RTTY Contest**
Aug 27-28	**Occupation Contest**
Sep 3	**DARC Corona 10-Meter RTTY Contest**
Sep 9-11	**Connecticut Oyster Festival**
Sep 10-11	**ARRL VHF QSO Party**
Sep 10-11	**Cray Valley Radio Society SWL Contest**
Sep 17-19	**Washington State QSO Party**
Oct 1-3	**Oregon QSO Party**
Oct 8-9	**ARRL QSO Party—CW**
Oct 9-10	**ARRL QSO Party—Phone**
Oct 15-16	**ARRL Simulated Emergency Test**
Oct 22-23	**MF Runde SW Activity Weekend**
Oct 22-23	**Clara Ac-Dc Contest**
Nov 5-6	**ARRL Sweepstakes—CW**
Nov 6	**DARC Corona 10-Meter RTTY Contest**
Nov 19-20	**ARRL Sweepstakes—Phone**
Dec 3-4	**ARRL 160-Meter Contest**
Dec 10-11	**ARRL 10-Meter Contest**

RESULTS

VERMONT QSO PARTY—1983

State	Call	Award	Score	Name	County/ Province
AR	WB5RYB	*	36	Johnson, B.	
AZ	AK7J	*	8	Eliason, C.	
CA	N6CPQ	*	1	Kitchens, J.	
FL	K4DDB	*	90	Earp, R.	
FL	N4FBY		40	Mach, T.	
IL	W9QWM	*	4	Schrock, H	
IN	W9XD	*	9	Drudge, D	
KS	N0CLV	*	10	Gregory, B.	
LA	W5WG	*	85	Owen, W.	
MA	KA1HFN	*	36	Harris, D.	
MA	K1BA		24	Bacon, A.	
MD	WA3EOP	*	24	Pyne, W.	
MD	W3QYL		4	Freidmann, D.	
MO	WB0SET	*	45	Hawley, P.	
MS	W5UCY	*	48	Croysdale, L.	
NH	W1OC	*	120	Littlefield, N. (multi-op)	
NH	AF1T		35	Clement, D.	
NJ	N2CJJ	*	32	Langston, R.	
NJ	WA2ASQ		4	Hausleben, P.	
NM	KB5DQ	*	1	Ridley, D.	
NY	WB2TKD	*	40	Harodecki, M.	
NY	N2BFG		20	Moseson, R.	
OK	N5AFV	*	50	Mattis, A.	
OR	WD6EAW	*	8	Hamilton, T.	
PA	KA3DSW	*	2	Riegel, K.	
PA	WA3JXW	*	2	Christian, D.	
SD	KC0ZU	*	55	Kleinsasser, G.	
TN	KD4PP	*	8	Chaffin, D.	
TX	W5PWG	*	80	Short, D.	
TX	WA5DTK		36	Brewer, J.	
VA	N4GTU	*	24	Frankland, B.	
VA	KF4LY		6	Treadwell, B.	
VT	W1AIM	*	32460	Taylor, G.	Washington
VT	WA1KPJ	**	29172	Vanat, J.	Lamoille
VT	N1BRT	***	26727	Woodworth, F.	Washington
VT	W2DMC/1	#	24656	Crystal ARC (multi-op)	Windham
VT	K1HKI		24000	Deforge, R.	Orange
VT	KK1U		8134	Nevin, D.	Washington
VT	W1POB		770	Read, B.	Windsor
VT	WA1GYS		120	Merrick, K.	Orange
WA	KN7L	*	33	Parker, C.	
WY	WB7EMA	*	28	Culver, A.	
WY	KC7QE		18	Sutherland, W.	
LU	LU5AMF	*	4	Anselmi, H.	

Legend:

* = 1st in state/county
** = 2nd in state
*** = 3rd in state
\# = 1st multi-op (VT only)

BROTHERS AND SISTERS QSO PARTY

The Central Oregon Radio Amateurs (CORA) are sponsoring the contest that will run from 0600 PST Saturday, July 23, until 1200 PST Sunday, July 24. Operations will be from WN7ODD in Brothers, Oregon, and N7CSH in Sisters, Oregon. Phone frequencies will be 10 kHz up from the bottom portion of the General bands. CW will be 15 kHz up from the bottom portion of the Novice bands. QSL via CORA, PO Box 723, Bend OR 97709. Enclose a business-size SASE for return QSL cards.

CW COUNTY-HUNTER'S CONTEST

Starts: 0000 GMT July 30
Ends: 0200 GMT August 1

The CW County-Hunter's Net invites all amateurs to participate in this year's contest. All mobile and portable operation in less active counties is welcomed and encouraged. Stations may be worked once per band and again if the station has changed counties. Portable or mobile stations changing counties during the contest may repeat contacts for QSO points.

EXCHANGE:

QSO number; category (P for portable, M for mobile); RST; state, province, or country; and US county. Stations on county lines give and receive only one QSO number, but each county is valid for a multiplier.

FREQUENCIES:

3575, 7055, 14065, 21065, and 28065. It is strongly requested that only P- or M-category stations call CQ or QRZ on 40 meters below 7055 and on 20 meters below 14065, with all other stations spreading out above those frequencies.

SCORING:

QSOs with fixed stations are 1 point, QSOs with portable or mobile stations are 3 points. Multiply the number of QSO points times the number of US counties worked. Mobiles and portables calculate their score on the basis of total contacts within a state for the state certificate, and on all operation if they operated from more than one state in competition for the High Portable or High Mobile Trophy.

AWARDS:

Certificates will be awarded in three categories:
1) Highest fixed or fixed portable station in each state, province, and country, with 1,000 or more points.
2) Highest station in each state operating portable from a county which is not his normal point of operation, with 1,000 or more points.
3) Highest station in each state operating mobile from 3 or more counties, with a minimum of 10 QSOs in each of at least 3 counties.

Plaques will be awarded to the highest mobile and portable stations in the USA who meet the above requirements for certificates. Additional awards will be issued where deemed appropriate.

ENTRIES:

Logs must show category, date/time in GMT, station worked, band, exchanges, QSO points, location, and claimed score. All entries with 100 or more QSOs must include a check sheet of counties worked or be disqualified from receiving awards. Enclose a large SASE if results are desired. Logs must be postmarked by September 3 and sent to: CW County-Hunter's Net, c/o Jerry Burkhead N6QA, 7525 Baltic St., San Diego CA 92111.

THE ARC LITE

NEWSLETTER OF THE MONTH

To create a good club newsletter, you don't have to have fancy graphics, typeset text, or professional writers—just a desire to inform and entertain your readers and a willingness to work at it. *The Arc Lite*, newsletter of the Garland Amateur Radio Club in Garland, Texas, is a perfect example of what can be done with simple resources and a little elbow grease.

The Arc Lite is neither typeset nor printed, but the first impression you get is that it is very clean. Obvious care has been taken in its layout, making the most advantageous use of white space without creating an empty look. Each page is bordered with a black line, and stories of special note—such as a recent issue's news flash of the expanded 20-meter phone band—are boxed, giving the newsletter the ambience of a tabloid newspaper.

Each section has been painstakingly labeled with a handsome headline and when a story jumps from one page to another, you are told where it has been continued.

Oddly enough, *The Arc Lite*'s contents are not that variant from the offerings of most other newsletters. Minutes of the last meeting, club news, and information on the club's repeater and station are all standard fare. But there is a difference. The sentences are complete. Misspellings are rare. For newsletter editor Gary Engleman K5HGL, the world of grammar and syntax is obviously not uncharted territory.

In his editorial, "de: Editor," Gary notes that he is selling advertising to help support the new *Arc Lite* format which he created. Gary has obviously seen a need for improvement and engineered a way to make the new idea work.

If your club takes pride in its newsletter, *73* wants to see it. To enter in *73*'s contest, send a copy of the newsletter to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

ARMADILLO RUN

Starts: 0001 GMT July 30
Ends: 0200 GMT August 1

The Texas DX Society announces its contest to assist CW operators in gaining USA-CA All Counties Award status. The TDXS will activate all Texas counties by dispatching mobile stations from Houston and activating these stations during the County-Hunter's CW Contest. Several fixed stations will also be activated. To ensure that the largest number of entrants receive equal opportunity to work the mobile stations, operating will generally be restricted to 20 meters.

Entry class for the Armadillo Run is single operator from out of Texas only. Operators must operate from their own station. Mobile operation will generally be restricted to 14055-14075 MHz. Operation on other bands will be in accordance with the County-Hunter's CW Contest rules. During the contest, call CQ TDXS on 14050, 7085, or 3585 and a control station (W5DOZ, K5NA/2, N6HUP) will answer your call and try to answer questions. Information regarding which station will activate specific counties may be received by writing or calling KZ5M between 6:30 and 8:00 pm CDST at (713)-343-1060.

EXCHANGE:

So as not to distract from the County-Hunter's CW Contest, use the same exchange as that required by that contest; QSO number; category (P-portable, M-mobile); RST; state, province, or country; and county for USA stations.

SCORING:

The contest score will be equal to the total number of Texas counties contacted during the contest period. Ties will be broken by the Texas QSO count.

AWARDS:

A unique plaque will be awarded to the station operator contacting the most Texas counties during the contest period. The plaque winner will be flown to Houston for the 1983 ARRL National Convention to receive the award if he contacted over 175 Texas counties. Certificates will be awarded to entrants contacting at least 50 counties. Endorsements will be issued for the following county levels: 100, 150, 175, 200, 225, and 250, as well as All Texas Counties.

ENTRIES:

To qualify for award consideration, log information containing Texas stations worked, time (GMT), band, and the county the station was operating from shall be sent to: the Armadillo Run Chairman, Dennis Motschenbacher KZ5M, PO Box 82, Thompsons TX 77481. Mailing deadline is August 31, 1983. Entrants may forward QSLs to the above address for Texas QSOs made during the contest period. The TDXS will make special efforts to ensure that QSLs received are answered!

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

JORDANIAN AWARDS

The Arabian Knights Awards

This award is issued by the Arab Radio Amateur League (ARAL) members and presented by His Majesty King Hussein (JY1) of Jordan.

To qualify for this recognition of achievement, amateurs must have proof of having contacted at least ten Arab countries, and one contact must be with either JY1 or JY2. All contacts must be made on or after January 1, 1971, on any authorized mode of communications. There are no special endorsements.

To apply for the Arabian Knights Award, the applicant must prepare a list of claimed contacts in prefix order. Each entry must also include the date and time in GMT, the band and mode of operation, and the station worked.

Do not send QSL cards, as photocopies will be accepted. As an alternative, you may have your list verified by two local amateurs, a local radio club secretary, or a notary public.

Enclose this list along with an award fee of ten IRCs and send to the attention of: JY1 Award Manager, PO Box 1055, Amman, Jordan.

The Royal Jordanian Awards

To amateurs throughout the world who qualify, JY1, His Majesty King Hussein I of Jordan, will issue a very elegant award of achievement to recognize one of two levels of accomplishment.

First, the Silver Award is offered in recognition of having worked six different JY prefixes. There are no band or mode restrictions; however, all contacts must be on or after January 1, 1971, to count.

The second and probably the toughest award of all to obtain is the Coral Award, which is issued to amateurs who visit Jordan and make a QSO from Aqaba. Simple, huh? Anyone for a charter trip this winter?

As with all awards sponsored by our Jordanian friends, applicants must prepare a list of claimed contacts made, citing the usual logbook information including RS(T).

Forward this list, stating which award it is you are applying for, along with an award fee of ten IRCs to: JY1 Award Manager, PO Box 1055, Amman, Jordan.

DX AWARDS FROM ITALY

A very good DX friend of yours and mine, John Paul I8KDB, wrote a very complimentary letter about our awards column and asked that we share the awards

ARAB COUNTRIES

JY1	King Hussein
JY2	Royal Jordanian Family
A4X	Oman
A6X	United Arab Emirates
A7X	Qatar
A9X	Bahrain
CN	Morocco
HZ, 7Z	Saudi Arabia
J2	Djibouti
JY	Jordan
OD5	Lebanon
ST	Sudan
SU	Egypt
YK	Syria
YI	Iraq
3V8	Tunisia
4W	Yemen
5A	Libya
5T5	Mauritania
60	Somali
70	South Yemen
7X	Algeria
9K2	Kuwait

program sponsored by the Associazione Radiotecnica Italiana (ARI). John Paul noted that the following general rules apply to all HF awards issued by the ARI and recommended that they be read together with the conditions governing each individual certificate.

All inquiries and/or applications should be addressed to the ARI Awards Manager, Giampaolo Nucciotti I8KDB, Via Francanzano, 31-80127 Napoli, Italy, and include 2 IRCs for airmail reply.

ARI awards will be issued to any amateur who submits a letter, dated and signed, with applicant's name, address, and call. He must certify that he has complied with all rules governing amateur radio in his country and that he has operated with fair play and good sportsmanship; he must include a complete list of QSLs, with callsign, date, frequency, reports, time, and type of emission (CW, AM, SSB, RTTY); and he must submit QSLs for checking. QSL cards must be submitted without corrections, erasures, or additions and must be clearly readable; include US $1.00 or 10 IRCs for foreign applicants. The Marconi Award is free; only a mailing fee is charged.

To get an award in a specific class, the cards must show the corresponding data in a clear format. Foreign applicants may avoid sending QSL cards by submitting a checklist of the cards duly certified by an appointed or elected official or a national amateur-radio-affiliated society or club. The ARI Award Manager reserves the right to check, on request, one or more claimed contacts, as necessary.

Certificato Del Mediterraneo (CDM)

The CDM is issued to those amateurs who can show confirmation of a two-way contact on the HF bands since June 1, 1952, with (a) one fixed station in each of at least 22 countries of the list shown below, and (b) at least 50 amateur stations located in peninsular Italy—an accumulated total of 72 QSLs.

The same station may be worked only once. Two classes of CDM are offered: mixed (AM, SSB, CW, RTTY) or phone only (AM, SSB). The minimum reports allowed to qualify are RS 33 and RST 338.

Countries list: Spain, Balearic Islands, Ceuta and Melilla, Morocco, France, Algeria, Corsica, Sardinia, Sicily, Lebanon, Egypt, Greece, Dodecanese Islands, Crete, Mount Athos, Turkey, Syria, Yugoslavia, Albania, Malta, Gibraltar, Cyprus, Monaco, Tunisia, and Libya.

Worked All Italian Provinces (WAIP)

This province award is issued to those amateurs who can show confirmation of a two-way contact on the HF bands since January 1, 1949, with one fixed station in each of at least 60 provinces of the Italian Republic for foreign amateurs, or one in each of 75 provinces for Italian amateurs. The same station may be worked twice or more if it's in a different province each time. Minimum reports acceptable are RS 33 and RST 338. Starting January 1, 1978, this award may also be endorsed for single band and/or for all 95 provinces.

List of Italian provinces: Agrigento, Alessandria, Ancona, Aosta, Arezzo, Ascoli Piceno, Asti, Avellino, Bari, Belluno, Benevento, Bergamo, Bologna, Bolzano, Brescia, Brindisi, Cagliari, Caltanissetta, Campobasso, Caserta, Catania, Catanzaro, Chieti, Como, Cosenza, Cremona, Cuneo, Enna, Ferrara, Firenze, Foggia, Forli, Frosinone, Genova, Gorizia, Grosseto, Imperia, Isernia, L'Aquila, La Spezia, Latina, Lecce, Livorno, Lucca, Macerata, Mantova, Massa, Matera, Messina, Milano, Modena, Napoli, Novara, Nuoro, Oristano, Padova, Palermo, Parma, Pavia, Perugia, Pesaro, Pescara, Piacenza, Pisa, Pistoia, Pordenone, Potenza, Ragusa, Ravenna, Reggio Calabria, Reggio Emilia, Rieti, Roma, Rovigo, Salerno, Sassari, Savona, Siena, Siracusa, Sondrio, Taranto, Teramo, Terni, Torino, Trapani, Trento, Treviso, Trieste, Udine, Varese, Venezia, Vercelli, Verona, Vicenza, and Viterbo.

LIST OF QUALIFYING CONTACTS FOR DGM

Country	Specific region or city	Prefix
Capo Verde Island	Any	D4C
Portugal	Lisbon	CT1
Madeira Island	Any	CT3
Morocco	Any	CN8
Spain	Cadice	EA7
Ireland	Any	EI
France	Any	F
Corsica	Any	FC
England	London	G
England	Flatholm Island	GB
England	Wight Island	G
Northern Ireland	Any	GI
Scotland	Any	GM
Switzerland	Any	HB
Vatican	Any	HV
Italy	Bologna	I4
Italy	Any	I5
Italy	Rome	I0
Italy	Fondaz G. Marconi	IY4FGM
Italy	Torre, Tigullio Marconi	IP1TTM
Italy	Sicily	IT9
Italy	Sardinia	IS0
Japan	Any	JA
Argentina	Buenos Aires	LU-A-B-C
Belgium	Any	ON
Brazil	Rio de Janeiro	PY
Sweden	Stockholm	SM
Sweden	Gotland Island	SM1
USSR	Leningrad	UA1
Canada	Any	VE1
Newfoundland	Any	VO1
Labrador	Any	VO2
Australia	Sydney	VK2
Bermuda	Any	VP9
USA	Massachusetts	W1
USA	New York State	W2
USA	New Jersey	W2
USA	Missouri	W0
USA	Illinois	W9
India	Any	VU
Gibraltar	Any	ZB
Yugoslavia	Any	YU2
Libya	Tripoli	5A
Any	Memorial Stations	Any

Diploma Guglielmo Marconi (DGM)

This award celebrates the experiments carried out by Marconi in various parts of the world and brings them once again to the attention of radio amateurs. The DGM will be awarded to those who make contacts with the localities in which Marconi once conducted his experiments. To qualify, it is necessary to forward to the ARI all details of your contacts and a) 40 QSLs chosen from the list of contacts for DGM, or b) 35 QSLs chosen from the list plus the QSL from the official commemorative station, II4FGM, and one from any other G. Marconi memorial station, for a total of 37 QSLs.

When required (i.e., G = London, I4 = Bologna), the QSLs must indicate the city or region of the locality. The DGM is made available for AM, SSB, CW, RTTY, SSTV, and mixed modes. There is no band limitation; however, all contacts must be made on or after January 1, 1973.

QRP INTERNATIONAL

Being somewhat of a 10-meter QRP enthusiast, using a converted CB rig, I contacted Hugh Aeiker WA8CNN, who happens to be the Awards Custodian for the QRP Amateur Radio Club International. After hearing everyone on the band claiming to run QRP or QRPp, I figured once and for all I would get the true definition of these terms from one of the originators of an organized QRP group. Not only did I get this group's point of view as stated in their constitution and by-laws, but also I became the recipient of a full packet of information concerning their awards program.

It appears that this QRP fraternity, founded in 1961 by K6JSS, set the QRP standard to mean 100 Watts CW/AM or 200 Watts PEP input. As for QRPp status, we find the group recognizing this power only in the 5-Watt or less range. Now this is not to be confused with standards set by other QRP societies, such as the Michigan QRPp Club International, which also defines QRPp as under 5 Watts output, yet QRP is much less than 100 Watts.

As for their awards program, it is packed full of incentives, as you'll witness by reading on.

The main objective of the QRP ARC International Awards Program is to demonstrate the use of limited power which creates less QRM on the amateur bands, while still allowing us to enjoy the usefulness of the hobby. The club issues the following awards which are available to any amateur meeting the requirements as set forth for each below.

QRP-25

This award is issued to any amateur working at least 25 members of the QRP ARC International. Endorsements are issued for 50, 100, 200, and every additional increment of 100. To apply, send copies of logbook data, $1.00 or 5 IRCs, and a signed statement that you limited your power to 100 Watts input (200 Watts PEP SSB). Your list should also include the membership numbers of each station worked. There are no restrictions on band or mode recognition.

WAC-QRP

This award is issued to any amateur for confirmed contacts with low-power stations in all six continents. Power inputs again must be carefully adhered to and a statement must be made certifying the power was within rules governing the program. Keep in mind also that both your own station and the station you are contacting must be using QRP to qualify. Your QSL cards received must state the station's power used. Fee is $1.00 or 5 IRCs.

WAS-QRP

This WAS award is issued to any amateur using QRP power who contacts stations, one in each of the 50 US states, who are also using QRP power or less. Award fee is $1.00 or 5 IRCs. GCR apply.

DXCC-QRP

This DX award is issued to any amateur who utilizes QRP power and contacts 100 different countries, each of which must also be using low power as must be stated on their QSL card. To apply, send log data and $1.00 or 5 IRCs. GCR apply.

KM/W 1000-Mile-Per-Watt Award

This award is issued to any amateur transmitting from or receiving the transmissions of a low-power station, such that the Great Circle bearings between both sides divided by the power input of the low-power station equals or exceeds 1000 miles per Watt. Confused? Ah, it's not all that bad! Special endorsements are given for single-band or mode achievements. To apply, send copies of full log data including power used on both sides, signal reports exchanged, band and mode, and specific location of QTH on both sides. Include $1.00 or 5 IRCs. GCR apply.

DXCC-QRPp

Issued to any amateur for confirmed contacts with stations in 100 DX countries; power levels of 5 Watts or less must be used by the applicant. Reading the rules closely, I find no power restriction on the stations you must work. To apply, send log-book data, including power used and type of equipment used. Enclose $1.00 or 5 IRCs. GCR apply.

WAS-QRPp

Issued to any amateur for confirmed contacts with each of the 50 US states while operating 5 Watts maximum output. To apply, forward all pertinent log data and $1.00 or 5 IRCs to the Award Manager. GRC apply. Application for the award may be made when the first 10 states have been worked, with further recognition at the 20, 30, 40, and, finally, 50 levels.

As with all awards offered by the QRP ARC International, in order not to delay processing of your award, please furnish not only the data, but also the power levels used for each award and the type of equipment used.

All award applications should be sent to: Hugh Aeiker WA8CNN, 5 Keiffer Drive, St. Albans WV 25177.

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My special thanks go out to Ade W0RSP/K8EEG, QRP editor for *CQ Magazine*, who recently provided me with the latest up-to-date information concern-

ing some very popular awards being offered by amateur fraternities.

DXCC-QRPp

This award, initiated in 1971 by the *Milliwatt: National Journal of QRPp*, offers a very distinctive challenge to dedicated QRPp stations the world over.

The award requires contacts with DX stations in 100 different countries of the world with the aid of list- or net-type operations. The rules clearly state that power must be limited to five Watts or less output. To apply, the applicant must submit a log in alphabetical order of callsign prefix of the station worked, indicating date, time, and frequency of each contact. QSL cards must accompany your listing and a signed declaration must be made as to the maximum power and type of equipment used. Application fee is $15.00 to help defray the cost of the large 30-inch engraved trophy.

DXCC Milliwatt

This award is also sponsored by the *Milliwatt: National Journal of QRPp*. The same rules apply for this award as for the DXCC-QRPp except that all indications of power level should read "under one Watt output." Applications are the same as for DXCC-QRPp.

The *Milliwatt* Field Day Trophy

Initiated in 1970, this trophy is awarded to the highest-scoring QRPp station in the ARRL Field Day event held each year in the month of June. To enter, you must submit an ARRL summary sheet, plus a listing of the stations you worked, band by band. You must state in your application the power level used, the type of equipment, and your method of measuring output power. If you use 1–5 Watts, you may multiply your score by four.

For power levels less than one Watt, you may multiply your score by 5. In addition, another 1.5 times your score may be added for operating your QRPp station independent of power mains. Another 150 bonus points are earned for full portable setup away from your QTH.

All three awards, the DXCC-QRPp, the DXCC Milliwatt, and the *Milliwatt* Field Day Trophy, are obtainable by making application to: Adrian Weiss W0RSP, 83 Suburban Estates, Vermillion SD 57069.

XV WORLD JAMBOREE MONDIAL

The Calgary Amateur Radio Association will be operating VE6WSJ from the site of the XV World Jamboree Mondial on July 1–16, 1983. The station will operate all bands and modes. Suggested frequencies: 7.030 MHz CW on the half hour; 14.190 SSB on the hour.

NATIONAL TOM SAWYER DAYS

The Hannibal Amateur Radio Club, Inc., will issue a third annual special certificate from the National Tom Sawyer Days celebration in Mark Twain's boyhood hometown, Hannibal, Missouri, on July 3–4, 1983. Hours: 1500–2100 UTC both days. Frequencies: phone—7.245, 14.290, 21.400, and 28.770; CW—7.125 and 21.125 MHz. Help us celebrate! To receive the certificate, send a large (8 × 10) SASE and your personal QSL card confirming the contact to Hannibal Amateur Radio Club, Inc., W0KEM, 2108 Orchard Avenue, Hannibal MO 63401. For further information, contact Tony McUmber at the above address or call (314)-221-6199.

SPACE DAY '83

The Cascades Amateur Radio Society (CARS), in conjunction with the Michigan Space Center in Jackson, Michigan, is offering a Space Day certificate to all stations who work WB8CSQ during Space Day activities. Look for WB8CSQ on 3.900, 7.235, 14.285, 21.360, and 28.510 starting at 0000 GMT July 9 through 1700 GMT July 10. A one-dollar contribution is asked to cover cost of postage and materials. Mail your log information and $1.00 to CARS, Space Day '83, PO Box 512, Jackson MI 49204.

USS COD

Having started in June, members of the Northern Ohio Amateur Radio Society will be operating daily through Labor Day from the *USS Cod*, a World War II submarine on permanent display at the port of Cleveland, Ohio.

Using the callsign K8KRG, NOARS members will be operating in the lower portion of the General band on 80 through 10 meters. Special Novice operations will be conducted on July 9 and 10 and August 20 and 21. On those dates, signals from the *USS Cod* will be found in the middle of the Novice band.

A special 8 × 11 certificate will be available upon request. Please send a QSL confirming the contact and $1 for handling and postage to WD8RZG, 8927 Torrance Ave., Brooklyn OH 44144.

ANNIE OAKLEY SPECIAL EVENT STATION

Again, it is the pleasure of W8UMD, the Treaty City Amateur Radio Association, Inc., to bring you the Annie Oakley Special Event Station from Greenville, Ohio, on Saturday, July 30, and Sunday, July 31, 1983. We will be operating from the Garst Museum which houses two rooms of memorabilia, guns, trophies, and costumes of "Little Sharpshooter," the name given to Annie by Chief Sitting Bull. Operating times will be 1400 to 0100 UT on Saturday and 1400 to 2200 UT on Sunday. Frequencies will be 20 kHz up from the General phone portion of the 40- and 20-meter bands, with excursions into the Novice segments of 40 and 15 meters. Your QSL and an SASE to TCARA, PO Box 91, Greenville OH 45331, will bring you a beautiful certificate and a pamphlet about Annie Oakley.

DETROIT ARSENAL

The Tank-Automotive Command ARC will operate W8JPW on 30 July 1983 from 1300-2000Z to commemorate the 42nd year of the Detroit Arsenal, home of the nation's first defense plant and the US Army Tank-Automotive Command. Frequencies: phone—7.250–7.274, 21.400, and 146.49 MHz; CW—7.055 from 1500–1700Z. Please put your QSO number and frequency on upper left-hand corner of your outer envelope. For an unfolded certificate, send a 9" × 12" SASE to: W8JPW, US Army Communications Command, Attn: CCNC-TAC-M, 28251 Van Dyke, Warren MI 48090.

BIX BIEDERBECK

The Davenport Radio Amateur Club will operate W0BXR to commemorate the great jazz player Bix Biederbeck and the city of Davenport during the Bix Biederbeck Memorial Jazz Festival, from 1600Z July 30 to 0300Z July 31, and from 1600Z to 2300Z on July 31. Operation on phone and CW, all bands about 10 kHz up from lower end of General-class band edges. To receive a certificate, send a large SASE to DRAC, c/o David Johannsen WB0FBP, 2131 Myrtle St., Davenport IA 52804.

LINCOLN BOYHOOD MEMORIAL

The Pike County Amateur Radio Club will operate station W9CZH from the Lincoln Boyhood Memorial, Lincoln City, Indiana, from 1700Z July 30 to 1700Z July 31. Special QSLs will be issued for your QSL and an SASE to Richard Bailey KC9VH, Box 311 RR 1, Winslow IN 47598. Frequencies will be: 3.925, 7.265, 14.305, and 21.395 phone; 14.090 RTTY; 146.52 FM; and 7.133 CW.

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
c/o 73
Peterborough NH 03458

I'm going to start out this month by answering a question I raised last month, one that I'm sure has been just burning in the minds of many of you. Just what does Mr. Ferrell do with stations lacking a callsign in the alphabetical listings in his new *Guide To RTTY Frequencies*?

Well, shortly after last month's column was put to bed, I received a full copy of this new book, and I now can tell you the answer—they are not included in the alphabetical-by-callsign list. Only those stations with callsigns are! Reviewing the pages in the missing signature also shows a neat, short treatise on callsign origins and some other trivia in the same vein. Makes a good bit of reading. The second edition *Guide To RTTY Frequencies* is available from Gilfer Associates, Inc., PO Box 239, 52 Park Avenue, Park Ridge, New Jersey 07656, for $9.95. As always, plug this column when you write, ok?

Never in all my wildest expectations did I anticipate the veritable flood of responses to my offer of a 6800 and/or 6502 RTTY terminal program. In the past, several such comments have drawn but a lukewarm response, but not now! With more letters received than on any other single topic in the more than six years of this column, over half of the letters pleaded for 6800 software, with the majority of the others backing the 6502-based Atari 400/800. Let's take a look at a sample of what some of you said.

Philip Deem K9PD, Indianapolis, Indiana: "Let me identify myself as one of the very interested 6! (people worldwide interested in the 6800). I do, however, disagree that the 6800 is a dead system. This is possibly the only microcomputer ever offered whose purchasers have been able to make relatively inexpensive mods to remain current with the state of the art."

Horace Hall WB4OGM, Peterson AFB, Colorado: "In response to your request for comments . . . I, for one, would certainly be interested! I really don't think the 6800 is dead, though the ham fraternity may wish to hear more about the department-store computers since they are so readily available and the prices are so good. If all is lost for the 6800 and the new department-store computers are what RTTY hams want to hear about, then *at least* choose one with an honest-to-gosh keyboard. After all, we are going to have to type on them to get our messages across, so let's try to do so comfortably."

Weldy Moffatt VE5NM, Regina, Saskatchewan, Canada: "Please don't set the 6800 aside. There are a large number of these machines about and most are in the hands of persons that like to get into the innards. The 6800 on the S-50 bus is the ideal machine for the hobbyist that wants to tinker with hardware and software."

Joseph Ryan WB5LLM, Florence, Mississippi: "About dropping interest in 6800-based micros: Stop! Please don't give up on 6800-based micros. 6800 assembly-language programs can be cross-assembled to 6809 language."

Nick Hulbert KG5N, Lubbock, Texas: "The 6800 with the S-50 bus is an experimenter's dream. A person who likes to build and add to his system can simply put whatever he wants on the 30-pin card and plug it in. In fact, if I want to go to the 6809 or even the 6502, I can get a CPU card to do this and plug it into my 6800 mainframe. A far cry from what you can do with some of the other machines (easily). I'm trying to say that the 6800 is *not dead* and there are a bunch of units out there."

John Davison W9ZFN, Kirkwood, Missouri: "I am very much interested in anything you want to print on the 6800. It might be dead, but mine is very much alive! It is a D-1 Motorola evaluation board."

Thomas Hand WD4IUG, Louisville, Kentucky: "I am interested in a RTTY program for the 6800-type computer. I have an APF computer which I enjoy very much."

Of course, not everyone is so universally behind the 6800 as the ideal CPU. For example . . .

Howard Busson W8WGB, Akron, Ohio: "I quit reading your column when you got off on the 6800 kick. I would suggest that you lean more towards the el cheapos (like the color computer)."

Stephen Carter K0GVZ, Rifle, Colorado: "It is truly unfortunate that the market did not support the 6800-6809 microprocessors, because they were easy to program and had really quite elegant architecture. However, realities being what they are, I suspect that any article based on a 6800 would have an extremely limited audience. On the other hand, if you used the Timex-Sinclair, VIC-20, Atari, or Radio Shack Color Computer, the low prices of

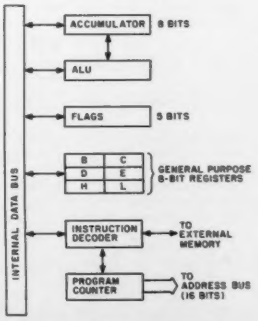

Fig. 1. 8080 block diagram.

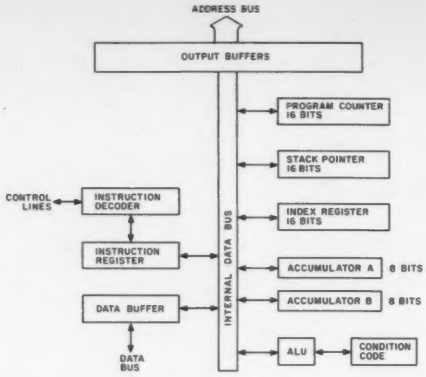

Fig. 2. 6800 block diagram.

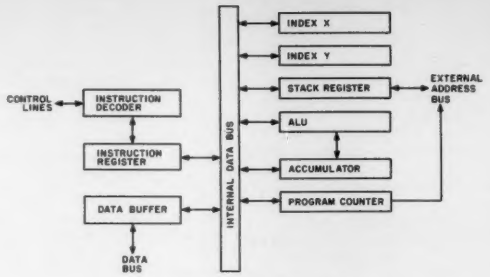

Fig. 3. 6502 block diagram.

these computers would make it feasible to buy one and dedicate it only to ham radio." I might point out to Steve that the CoCo *is* 6809-based.

James Theisen WB8REH, Gaylord, Michigan: "I am trying to understand machine code and hope to write or modify an existing RTTY program for the Pet." Stay tuned!

Rich Gehle N4DPQ, Nicholasville, Kentucky: "If you are considering a program for Atari on RTTY, please go for it. The present program is so restrictive and inconvenient, we are looking for relief."

It occurs to me that, to a large extent, a good deal of the above may be beyond the ken of many readers. 6800, 6809, 6502, 8080, Z-80—these are the substances of articles in *Byte* or *68 Micro Journal*, material rarely consumed by the average amateur. The truth is, for most commercially-available systems, the software offered is far more important than the central processing unit, or CPU, which is what all those numbers above were all about. But, if we will be writing software, we are going to have to commit to a particular CPU, or at least a similar group. Perhaps a look at history will be revealing.

In the beginning, there was no microprocessor, only big computers with tubes or discrete solid-state devices. After much work, trying to produce a general-purpose calculator integrated circuit, the Intel 4004 was born. This four-bit handler was the forefather of today's microcomputer breed. The next step was increasing the data capacity to eight bits, and the 8008 was born. I still remember the Mark-8 computers, home-brewed to use this chip in the early 1970s. An updated 8008 was introduced by Intel in 1973, called the 8080, and within two years the microcomputer revolution was off and running.

The design philosophy of the 8080 was an attempt to implement a calculator-type architecture on one chip, tracing back to the 4004 roots. Six general-purpose registers, stack and program counters, and a flag register work with one accumulator to provide internal data manipulations. Input and output is directed over special I/O channels. A block diagram of the Intel 8080 is shown in Fig. 1.

A year after the introduction of the 8080, Motorola presented its version of the eight-bit microprocessor, the 6800. Rather than the register orientation of the 8080, the 6800 is memory-oriented, that is, any memory location can serve as data, instructions, a register, or even an input/output device. By freeing up the organization, the 6800 becomes easier to program, and the more flexible addressing allowed by the 6800 makes this series, and ones to follow in this line, inherently more powerful. Fig. 2 shows the simple organization of the Motorola 6800, which contains two accumulators, an index register, stack and program counters, and condition code, or flag, register.

The next move was taken by several ex-employees of Motorola who joined forces with a calculator chip manufacturer, MOS Technology, to produce an enhanced 6800. The index register, a two-byte pointer in the 6800, was broken into two eight-bit index registers, and new modes of addressing were added. The B accumulator was discarded, and other refinements were made to some of the internal architecture. The result was the 6502, the block diagram of which is shown in Fig. 3.

The net result is that there are two major families among popular microcomputers: the 8080, with its enhanced version, the Z-80, and the 6800, 6502, and lately the 6809, an enhanced 6800, series. Although important differences exist between members of these groups, as a rule programs that are written for one may be translated, not always directly, from one to the other.

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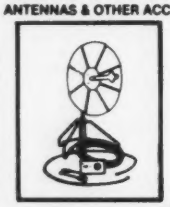

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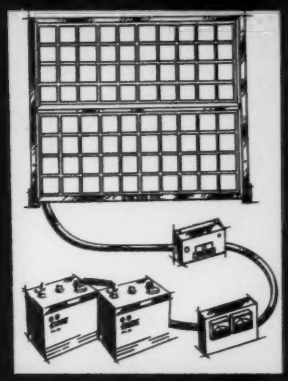

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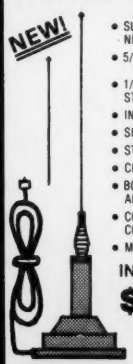

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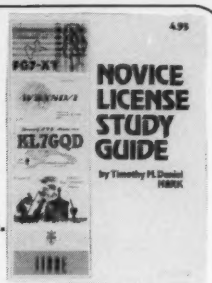

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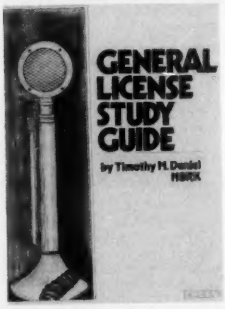

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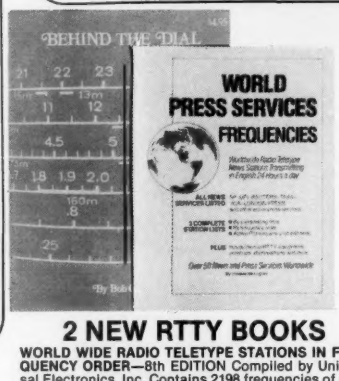

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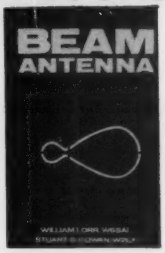

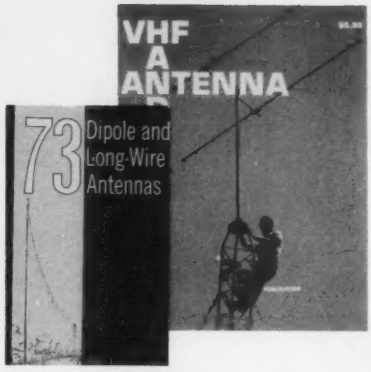

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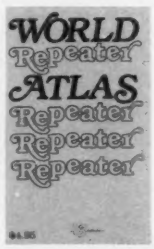

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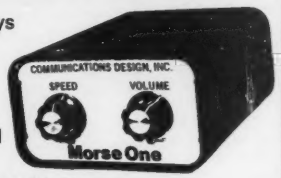

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WAS YOURS BIG ENOUGH?

The middle of the summer provides a time for reflection and anticipation for the DXer. DXing is at its worst of the year, with high absorption on the higher bands and static and noise on the lower bands. So the DXer reflects on "the ones that got away" last year and anticipates the next DX season.

In fact, the weather might even be nice enough to entice the DXer away from static crashes of the rig and outside for a critical look at the skyhook.

Have you ever heard of a DXer who is totally satisfied with his antenna farm? Summer brings thoughts of a "real" antenna. A *big* one! Wouldn't it be great to be known as a Big Gun . . . to be first in the pileups!

Alas, the limitations of the lot, the neighbors, and the pocketbook seem to rule out instant Honor Roll status, but perhaps a small upgrading is in order. After all, the bands are only going to get worse over the next few years, and there are many more DXers today than at the last sunspot minimum in 1975–6. Competition will be intense. More antenna and refinement of operating skills are the only defenses against deteriorating sunspot numbers.

"If your antenna lasted the winter, it wasn't big enough," the saying goes. Unfortunately, there are many amateurs whose antennas were indeed large enough for this past winter. For them, summer brings the chore of rebuilding, perhaps a little better than before, and on a stronger tower, of course.

Now that we're all in the mood for some serious antenna work, I must share the following. Picture an amateur sitting at a desk, laboriously writing a letter to an insurance company:

"I am writing in response to your request for additional information in block number three of the accident-reporting form. I put 'poor planning' as the cause of my accident. You said in your letter that I should explain more fully, and I trust that the following details will be sufficient. I am an amateur radio operator. On the day of the accident I was working alone on the top section of my new 80-foot tower. When I had completed my work, I discovered that I had, over the course of several trips up the tower, brought up about 300 pounds of tools and spare hardware. Rather than carry the now unneeded tools and material down by hand, I decided to lower the items down in a small barrel by using a pulley, which fortunately was attached to the gin pole at the top of the tower.

"Securing the rope at ground level, I went to the top of the tower and loaded the tools and material into the barrel. Then I went back to the ground and untied the rope, holding it tightly to ensure a slow descent of the 300 lbs. of tools. You will note in block number eleven of the accident-reporting form that I weigh only 155 lbs.

"Due to my surprise at being jerked off the ground so suddenly, I lost my presence of mind and forgot to let go of the rope. Needless to say, I proceeded at a rather rapid rate of speed up the side of the tower. In the vicinity of the 40-foot level, I met the barrel coming down. This explains my fractured skull and broken collarbone. Slowed only slightly, I continued my rapid ascent, not stopping until the fingers of my right hand were two knuckles deep into the pulley.

"Fortunately, by this time, I had regained my presence of mind and was able to hold on to the rope in spite of my pain. At approximately the same time, however, the barrel of tools hit the ground and the bottom fell out of the barrel. Devoid of the weight of the tools, the barrel now weighed approximately 20 pounds. I refer you again to my weight in block number eleven. As you might imagine, I began a rapid descent down the side of the tower. In the vicinity of the 40-foot level, I met the barrel coming up. This accounts for the two fractured ankles and the lacerations of my legs and lower body.

"The encounter with the barrel slowed me enough to lessen my injuries when I fell onto the pile of tools and, fortunately, only three vertabrae were cracked. I am sorry to report, however, that as I lay there on the tools in pain, unable to stand, and watching the empty barrel 80 feet above me . . . I again lost my presence of mind . . . I let go of the rope."

So now you are forewarned! I came across this gem in the Kansas City DX Association's newsletter. WØFI's column, *The Preacher's Corner*, credits the Sterling-Rock Falls newsletter. Anyone know the author of this delightful piece?

Seriously, antenna and especially tower work is dangerous stuff. Even a task as simple as changing the coax to the antenna can lead to life-threatening consequences. So take a little *extra* care the next time you climb your tower. Remember, the secret to DX success is longevity, not hardware. Live to DX another day!

Some of you have asked what happened to the DX column the last two months. A fierce relapse of the same pneumonia which curtailed my African DXpedition to 9L1CA, C5AAQ, and 6W8MM laid me low recently. Sorry about not being able to write the columns, and thanks for your cards and notes. I'll try to have some extra-special columns in the rest of the year.

Lloyd W6KG and Iris W6QL Colvin accept their 9K2QL license in the office of the Minister of Communications in Kuwait.

NOTES FROM ALL OVER

Tahiti FOØ Did you work Jay or Jan O'Brien W6GO and K6HHD while they operated from Tahiti in 1982? The husband and wife team racked up nearly 9000 contacts in their two-week stay in FOØ last October, sponsored in part by the International DX Foundation. About half of the team's contacts were with stateside stations, and another quarter of their QSOs came out of Japan. Ten meters was their most productive band, producing about half of their contacts. The 9000 contacts included 128 countries! The O'Briens survived a misplaced antenna and 100-kph winds during their DXpedition. Jay writes, "Had we not lost our 40- and 80-meter antennas to the winds, our totals [on these bands] would be higher, as this is where the demand exists." Jay and Jan made more than 4000 contacts in the *CQ* WW SSB contest.

QSL cards for FOØOJ (QSL via Jan K6HHD) and FOØJO (QSL via Jay W6GO) have been sent out in answer to cards received. If you haven't received yours yet, try another card. Incidentally, Jay and Jan, who publish a list of QSL managers, *The W6GO/K6HHD List*, got their FOØ callsigns reversed in the advance publicity. No problem; QSL either call through Box 700, Rio Linda CA 95673.

Lloyd W6KG and Iris W6QL Colvin made another Yasme-backed DXpedition this past year, hitting, among other places, Saudi Arabia, Qatar, and Kuwait. They report:

Saudi Arabia HZ "We visited HZ1TA and HZ1TC in the capital of Riyadh, which is a large modern city. It is unusual in that it is not uncommon to see stores closed, with many items that they sell left in front of the store unguarded. Also, stores can occasionally be found open with no attendant present. One reason for this is that the people are very religious, and secondly, if a thief is caught, his hand is cut off! We also visited HZ1AB in Dhahran. There are 30 operators there, and they agreed to let us make a Yasme DXpedition for the two days of the ARRL International CW DX Contest, 19–20 February, 1983. We made some 1500 QSOs in that period, with four of the regular operators helping. All QSLs for HZ1AB for these two days should go to Yasme, PO Box 2025, Castro Valley CA 94546."

Kuwait 9K2 "Our next stop was Kuwait, where we were extremely fortunate to re-

Jay W6GO/FOØJO installs the tribander at Moorea.

Jan K6HHD/FOØOJ made nearly 1500 contacts during her stay in Tahiti.

ceive the special call 9K2QL. This is the only special call issued to visiting amateurs in a long while. The first few days we stayed at the Marriott Hotel, which is a converted ocean liner, similar to the *Queen Mary* in Long Beach. The problem of operating there was that the portholes could not be opened and there was no way to get the coax line into the stateroom. We finally moved to one of the chalets nearby. We convinced the manager that our 3-element beam would be a desirable addition to the swimming pool and garden area of his 5-star hotel! We made 6500 contacts with amateurs in 125 countries from 9K2QL."

Qatar "Qatar is similar to Oman because it is a recently rich oil country with tremendous new expansion. Although the treatment of women here is more liberal than in the past, only approximately 5% of the people seen on the streets or in the restaurants of the modern city of Doha are women. The biggest supermarket in town has one day set aside just for women and their families. It is not felt appropriate to have single men and single women go shopping together!

"For the first time ever, we operated from a skyscraper building. Our antennas were located on top of a 14-story hotel with a perfectly clear view in all directions. The great height seemed to help us both on transmission and reception; we averaged consistently about two QSOs per minute while on the air. In three weeks of operating, we made 8000 QSOs with amateurs in 135 countries, on both SSB and CW, 10–40 meters.

"Visiting personnel of all kinds, especially radio amateurs, are not encouraged to visit in the Arabian countries. We are extremely grateful to Mike A71AD who has helped us enter and operate in several Arab countries."

CORRECTIONS

The fine photographs in my article "Build this Classic Transmitter" in the May, 1983, issue were taken by Steve Finberg W1GSL. It is with regret that I notice due credit was inadvertently omitted from the published article.

Penn Clower W1BG
Andover MA

In the time since publication of "Confessions of a Counter Evolutionary," in the August and September, 1982, issues of *73*, several errors have come to my attention. Some corrections were listed in the October, 1982, issue on page 142. The following is a list of the remaining known corrections:

Table 1: IC10-11 goes to IC1-1, not IC1-38.

Fig. 7: IC10-11 should be 20 Hz to IC1-1, not 50 Hz.

Fig. 7: IC3 is actually wired as IC2-7 to IC3-14, IC3-12 to IC3-1, and IC3-11 to IC5-15.

Fig. 11(a): IC24-8 to IC13-4 is correct, but the connector is not "E". Delete "E".

Fig. 13: "PM" IC23-4 connects only to IC14-12, not to IC36-1 and not to IC23-12.

Fig. 13: Gate omitted from schematic:

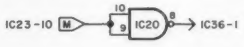


Fig. 16: IC36-1 should not connect to "PM", but to IC20-8, as above.

Fig. 16: Input to IC18-1 should be IC3-14, not IC1-3.

Fig. 23: IC13 is a 74C74, not a 4013.

Part I, page 107, column 1, line 11 reads: "A 50-kHz signal is picked off the TBOD chain." Replace with: "A 100-kHz signal is picked off the TBOD chain. Because the gate control circuit, Fig. 11(a), operates on a 50% duty cycle, the 100-kHz signal becomes, in effect, a 50-kHz clock."

IC24-1,2,3 is an unused gate.

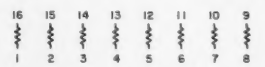
Thanks to WA1CST/7 and K2SHL for pointing out several of the above errors.

Display-Scan Modification

After a year of heavy use, the prototype WA2FPT counter blew a 75491 segment driver chip. It was replaced, but the new one failed after only a few weeks. I discovered empirically that Texas Instruments brand 75491 devices work more reliably in the published display scan circuit (see part I, page 105, Fig. 9) than National or ITT chips.

Sound engineering design practice should minimize such vendor dependency for circuit reliability, so I relented and added eight 10-Ohm, 1/4-W resistors, each in series with one of the eight segment lines to limit the current from the 75491 segment drivers, IC21 and IC25.

The resistors are mounted on a DIP header, socketed directly below IC35 and designated H2. See part II, page 52, Fig. 23. The resistors are mounted like this:



Here are the wiring changes for the display-scan modification.

SIGNAL	*AS PUBLISHED*	*MODIFICATION*
Segment a	IC25-9 to CONN-16	IC25-9 to H2-1 H2-16 to CONN-16
Segment b	IC25-6 to CONN-15	IC25-6 to H2-2 H2-15 to CONN-15
Segment c	IC25-2 to CONN-14	IC25-2 to H2-3 H2-14 to CONN-14
Segment d	IC21-13 to CONN-13	IC21-13 to H2-4 H2-13 to CONN-13
Segment e	IC21-9 to CONN-12	IC21-9 to H2-5 H2-12 to CONN-12
Segment f	IC21-6 to CONN-11	IC21-6 to H2-6 H2-11 to CONN-11
Segment g	IC21-2 to CONN-10	IC21-2 to H2-7 H2-10 to CONN-10
Segment D.P.	IC25-13 to CONN-9	IC25-13 to H2-8 H2-9 to CONN-9
Scan rate	IC6-15 to IC1-39 (1 kHz)	IC2-7 to IC1-39 (100 kHz)
Scan reset	IC10-11 to IC1-1 (20 Hz)	IC6-15 to IC1-1 (1 kHz)
D.P. clock	IC2-7 to IC18-1 (100 kHz)	IC2-15 to IC18-1 (1 MHz)
No name	IC35-7 to GND	IC20-6 to IC35-7 IC27-4 to IC20-4,5

The last four wiring changes altered the original scan display cycle to eliminate the 20-Hz flicker. The "no name" signal change resulted in the addition of another gate to Fig. 16:

Thank you for the favorable responses. If there are other errors or problems "encountered," please write and I will make every effort to resolve them.

D. N. (Nick) Ellis WA2FPT
57 Memorial Ave.
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	3	0050	97	0018	311	0039	322	0129	332	0001	306	3
	4	0054	98	0012	312	0024	320	0120	331	0158	337	4
	5	0059	99	0007	312	0008	317	0110	330	0155	338	5
	6	0103	100	0002	312	0151	345	0100	329	0152	339	6
	7	0107	102	0156	342	0136	342	0051	328	0149	339	7
	8	0112	103	0151	342	0121	340	0041	327	0146	340	8
	9	0116	104	0145	343	0105	338	0031	326	0143	341	9
	10	0120	105	0140	343	0050	335	0022	325	0141	342	10
	11	0125	106	0134	343	0034	333	0012	324	0138	343	11
	12	0129	107	0129	343	0019	331	0002	324	0135	344	12
	13	0133	108	0124	343	0004	328	0152	353	0132	344	13
	14	0138	109	0118	344	0147	356	0142	352	0129	345	14
	15	0142	111	0113	344	0132	354	0133	351	0126	346	15
	16	0003	86	0108	344	0116	351	0123	350	0123	347	16
	17	0008	87	0102	344	0101	349	0113	349	0121	348	17
	18	0012	88	0057	344	0045	347	0104	348	0118	348	18
	19	0016	89	0052	344	0030	344	0054	347	0115	349	19
	20	0021	90	0046	345	0015	342	0044	346	0112	350	20
	21	0025	91	0041	345	0158	9	0035	346	0109	351	21
	22	0029	93	0036	345	0143	7	0025	345	0106	352	22
	23	0034	94	0030	345	0127	5	0015	344	0104	353	23
	24	0038	95	0025	345	0112	2	0006	343	0101	353	24
	25	0042	96	0020	346	0056	0	0155	12	0058	354	25
	26	0047	97	0014	346	0041	358	0146	11	0055	355	26
	27	0051	98	0009	346	0026	355	0136	10	0052	356	27
	28	0055	99	0003	346	0010	353	0126	9	0049	357	28
	29	0100	100	0158	16	0153	21	0117	8	0047	357	29
	30	0104	102	0152	16	0138	18	0107	7	0044	358	30
	31	0108	103	0147	17	0123	16	0057	7	0041	359	31
Aug	1	0113	104	0142	17	0107	14	0048	6	0038	360	1
	2	0117	105	0136	17	0052	11	0038	5	0035	1	2
	3	0121	106	0131	17	0036	9	0028	4	0032	1	3
	4	0126	107	0126	17	0021	7	0019	3	0029	2	4
	5	0130	108	0120	18	0006	4	0009	2	0027	3	5
	6	0134	109	0115	18	0149	32	0000	1	0024	4	6
	7	0139	110	0110	18	0134	29	0149	30	0021	5	7
	8	0000	86	0104	18	0118	27	0139	29	0018	6	8
	9	0004	87	0059	18	0103	25	0130	28	0015	6	9
	10	0009	88	0053	19	0047	22	0120	28	0012	7	10
	11	0013	89	0048	19	0032	20	0110	27	0010	8	11
	12	0017	90	0043	19	0017	18	0101	26	0007	9	12
	13	0022	91	0037	19	0001	16	0051	25	0004	10	13
	14	0026	92	0032	19	0144	43	0041	24	0001	10	14

NEW PRODUCTS

ELECTRONIC SOLDERING SYSTEM

The new Electronic System 9000 temperature-controlled soldering system from the Ungar Division of Eldon Industries enables a tip temperature to be varied from 420 to 800 degrees F with an accuracy of ± 10 degrees.

Solid-state circuitry, including microcircuit chips, samples the tip temperature 120 times per second. LEDs on the temperature-controller instantly display each 20-degree temperature increment reached, creating an illuminated bar chart that clearly represents the tip temperature to within ± 10 degrees F.

Ungar's recently announced Thermoduric™ heating element, which combines a highly efficient heater and sensitive tip-temperature sensor, recovers tip temperature after each solder joint in less than one-half the time of other systems. The smaller heating element also makes possible a micro handle that is cooler than other models.

Electronic circuitry in the controller prevents tip-temperature overshoot that could easily cause faulty solder joints.

The controller can be calibrated by a front-panel adjustment, using room temperature as a reference. For ultra-precise soldering, any temperature within the temperature range can be calibrated to be accurate within ± 5 degrees F.

Following the modular concept of Ungar irons, the controller is separate from the soldering-iron holder assembly. The controller can be mounted on a wall, side of a bench, or other convenient location. A tray, useful for holding parts or small tools, is exposed on the stand when the controller is removed. The iron holder can quickly be changed to the left or right side of the stand.

The system is electrically conductive from the tip to a grounded wall plug to prevent static electricity damage to microcircuits.

Further information is available from *Ungar, 100 W. Manville St., Compton CA 90220; (213)-774-5950.* In Canada: *Eldon Industries of Canada, Markham, Ont. L3R 1H5, Canada; (416)-495-9407.* Reader Service number 483.

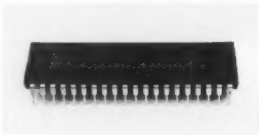
CONTROL CHIP

Digital Microsystems, Inc., a Massachusetts-based firm which has been active in the microcomputer and software business for seven years, has announced a family of custom-integrated circuits aimed primarily at the amateur and hobbyist markets. The integrated circuits make use of the latest in sophisticated Large Scale Integration (LSI) technology. Each is designed to be tailored to its application by the user through a wide range of programmable features. The first product to be announced is a single-chip repeater control circuit designed to meet amateur and industrial needs for low cost, high reliability, and high performance control of repeater stations. The new chip will be offered initially in commercial and extended temperature versions. A full military device is planned.

The single-chip repeater control features crystal-controlled timing accuracy for ID, tail, and time-out timers. The period of each timer is programmable by the user. In addition, each chip features an audio generator for generating the repeater station's callsign as well as several useful control messages such as "TEST" and "PF." The chips are equipped to interface directly with PL decoders and also feature a PL enable input.

Additional features include a tune input for holding the transmitter on while making adjustments, a "force ID" input for manual trigger of an ID sequence, user-selectable Morse code transmission rates, and compatibility with a planned autopatch controller.

For additional information, contact *Digital Microsystems, Inc., 607 Sudbury St., Marlboro MA 01752.* Reader Service number 484.



Control chip from Digital Microsystems, Inc.

Electronic soldering system from Ungar.

HEIL TRANSVERTER

A unique 2-meter-to-10-meter linear translator has been introduced by Heil, Ltd. This new product allows a transceiver covering 144.00 to 146.00 to transmit and receive from 28.00 to 29.70 MHz. The translator is limited to a 1-Watt input.

The model 210 is primarily designed for use in the 29.30-to-29.70-MHz FM mobile band, using a 1-Watt handie-talkie or mobile transceiver for excitation, but it is also usable on SSB, CW, AM, and RTTY by exciting with an all-mode 2-meter rig. The model 210 has three SO-239 connectors on the rear panel—a 2-meter 1-Watt input, a 2-meter antenna, and a 10-meter antenna. With the front-panel function switch in the Out position, the 2-meter antenna is connected to the 2-meter transceiver or handie-talkie. Switching to the In position will cause the transverter to operate and produce a signal in the 10-meter band. The receive sensitivity is .3 uV for 10 dB quieting. The output power is approximately 4 Watts out at 29.60 MHz.

For more information, contact *Heil Sound, Ltd., Heil Industrial Blvd., Marissa IL 62257.* Reader Service number 480.

AUTOPATCH AND DTMF DECODER MODULES

Hamtronics® recently released two new modules to complement their line of VHF and UHF repeaters. The Autopatch Module provides full telephone patch and reverse autopatch functions for a repeater or duplex rural radiotelephone installation. In addition, it allows primary repeater control via phone line *and* secondary control via the repeater receiver, and it allows a control operator to monitor the repeater receiver by telephone even when the transmitter is shut off.

The Autopatch features a choice of either automatic answer or on-air tone ringing when a party calls the reverse patch function. It also features automatic level limiting, time-out timer, tape-receiver relay for logging, and access-code-tone muting for security.

The DTMF Decoder/Controller Module can be used with the Autopatch, or it can be used alone for control of repeaters and other devices by radio link. It has outputs to control two on/off functions independently. Typically, it is used to control a repeater and autopatch, but there are many other remote-control jobs it can perform in radio, industrial, mining, and scientific applications. The decoder uses a four-digit DTMF code, and several safety features are provided for security against falsing or tampering. The unit is all solid-state (no relays) and uses commonly available ICs.

For more information, ask for *Autopatch Data Sheet* and a complete free catalog including information on transmitters, receivers, converters, repeaters, etc.; contact *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468-9535; (716)-392-9430.* (For overseas mailing, please enclose $1 or 4 IRCs.) Reader Service number 482.

TVRO RECEIVER

A TVRO receiver was introduced recently at the Satellite TV Trade Show by Gillaspie and Associates, Inc., of Sunnyvale, California. The Gillaspie 9600 completes the manufacturer's uniquely-designed six-foot system package—the first in the industry to offer a combination of optimized components that are each clearly defined and made to work with each other.

The receiver introduces several new features, including an infrared remote-control channel selector, customer-oriented controls, built-in polarity switching and tuning, and state-of-the-art video demodulation circuitry. Its design includes a walnut wood cabinet.

Gillaspie and Associates, Inc., expects to be able to manufacture 10,000 to 20,000 receiver units a month by the end of 1983. The product will be distributed through the company's exclusive distributors—North American Satellite Antenna in Fresno, California, Nevada Satellite in Las Vegas, Nevada, Satellite Communications Corporation in Silver Lake, Kansas, and Multivision in Oak Ridge, Tennessee—and a network of 800 dealers.

For additional information, contact *Gillaspie and Associates, Inc., 365 San Aleso Ave., Sunnyvale CA 94086; (408)-703-2500.* Reader Service number 485.

HF/VHF ANTENNA LINE

Ten-Tec, Inc., the amateur/commercial radio transceiver manufacturer of Sevierville, Tennessee, has just announced acquisition of the Bassett antenna line. The new Ten-Tec antenna line includes both multiband fixed-station and single-band mobile antennas.

The fixed-station trapped dipole antennas are offered in 13 models of two, three, four, and five band systems covering 10 through 75 meters. All models use helium-filled traps and baluns, stainless-steel hardware, and copperweld wire. Each model operates as a fundamental broadside dipole, band change is automatic, and no tuner is required to achieve vswr of 1.5:1 or less. Power ratings are 2 kW PEP.

The single-band mobile whip antennas feature helical inductors sealed in helium-filled lower sections with stainless-steel-top whips. Models are available for all bands from 2 through 75 meters. Average weight is just 6 oz., yet they remain vertical and resonant at all highway speeds and are impervious to weather. Power ratings are 750 Watts PEP.

Accessories include a single-hole 5/8" fiberglass Mobile Deck Mount and a non-inductive 5-band switchable Mobile Matcher to match 3-30-MHz mobile antennas to 50-Ohm coax. The balun, which features a helium-filled high-efficiency air core rated to 5 kW PEP, is also available separately, as are the helium traps for 30 meters.

The new acquisition also permits Ten-Tec to supply custom commercial mobile and fixed-station antennas.

For complete information, write *Ten-Tec, Inc., Sevierville TN 37862; (615)-453-7172.*

SWISS QUAD FOR 6 METERS

TET Antenna Systems announces its model SQ-61. The Swiss Quad is a two-element quad with both elements driven. The elements and the phasing line between them are made of aluminum tubing. The larger diameter of the tubing gives improved bandwidth over conventional wire-element quads. The elements are self-supporting, thus eliminating the usual support structure. This makes a lightweight antenna with low wind resistance.

The gain is higher than a 3-element yagi, but the turning radius is half that of a yagi. It is ideal when space is restricted. Both elements have trombone sections so they are easy to tune to favor any part of the band. Both elements are grounded to the boom, giving static discharge and lightning protection. The feed system matches 50-Ohm coaxial cable without need for a balun.

For further information, contact *TET Antenna Systems, 1942E W. Mission Road, Escondido CA 92025.* Reader Service number 477.

Yaesu's FT-726R multi-mode transceiver.

FT-726R TRIBAND MULTI-MODE TRANSCEIVER

Yaesu Electronics Corporation has announced the availability of the FT-726R, the world's first amateur HF/VHF/UHF transceiver capable of full duplex operation for satellite work.

The basic FT-726R comes equipped for 2-meter operation on SSB, CW, and FM. Optional units may then be plugged in, enabling operation on 10 or 6 meters, 430-440 or 440-450 MHz on 70 cm. The optional SU-276 Satellite Unit allows crossband full duplex operation, for simultaneous uplink transmit and downlink receive operation on amateur satellites.

Controlled by an eight-bit microprocessor, the FT-726R features a dual vfo plus memory frequency management system, with independent frequency/mode storage on each vfo or memory; mode-inverting satellite transponders are therefore covered with ease. The transmit and receive frequencies may be varied during satellite work to allow easy zero-beat capability while following Doppler shift.

Equipped with many features found only on HF transceivers, the FT-726R includes an SSB speech processor, i-f shift, variable i-f bandwidth tuning, i-f noise blanker, RIT, multi-mode squelch, and a receive audio tone control. A CW filter, DTMF encoding microphone (YM-48), desk microphone (MD-1B8), external speaker (SP-102), and CTCSS units are all available as options.

For more details about the FT-726R, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723; (213)-633-4007.* Reader Service number 479.

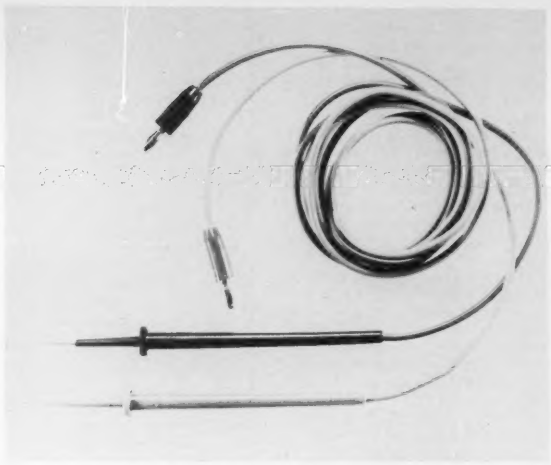
TEST LEADS

Two test lead sets have recently been placed on the market by Non Linear Systems, Inc. They consist of flexible silicone rubber leads, 48 inches in length, with a rated working voltage of 1000 volts ac rms and a maximum of 10 Amperes.

Each type is terminated at one end with insulated stainless-steel prods which may be extended by more than two inches. Extension, retraction, or locking the prods is easily accomplished by rotating a knurled ring on the probe from left to right. Testing in remote circuit areas is easy through the extendable-prod feature.

P/N 51-160 test leads are terminated at the other end with standard banana plugs for use with the NLS Touch Test 20 series digital multimeters or other instruments with standard banana-plug receptacles. P/N 39-895 test leads are terminated with mini banana plugs for use with NLS LM-type meters.

Both sets of test leads are available nationwide from local NLS electronics distributors. For additional information, contact *Non Linear Systems, Inc., PO Box N, Del Mar CA 92014.* Reader Service number 478.



New test leads from Non Linear Systems.

RECEIVER MULTICOUPLER

Two shortwave receivers may be operated from one antenna, thanks to a new multicoupler just released by Grove Enterprises, manufacturer of accessories for listening.

The CPL-2 multicoupler acts as a signal splitter, providing equal signal levels to two receivers simultaneously from one antenna.

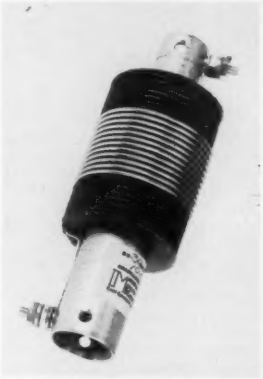
Designed for flat response from 3–30 MHz, the inexpensive splitter comes equipped with interconnecting cables and adapters for different types of lead-in connections.

A scanner verison of the multicoupler is also available as model CPL-1.

For further information, contact *Grove Enterprises, 140 Dog Branch Road, Brasstown NC 28902; (800)-438-8155* (except NC). In NC, call *(704)-837-2216.* Reader Service number 476.

30-METER ANTENNA COIL

Microwave Filter Company has released its KW-30 antenna coil which allows trapped dipole coverage of the new 30-meter band. The resonant frequency is designed to provide a perfect half-wave dipole. The KW-30's power handling capability is 2 kW PEP, and the tensile strength is 800 pounds. An acrylic lacquer waterproof coating and all-aluminum hardware help to resist interface corrosion on the 5.5" × 1.8" coil.



Microwave Filter Company's 30-meter antenna coil.

For additional information, contact *Microwave Filter Company, Inc., 6743 Kinne St., East Syracuse NY 13057; (800)-448-1666.* Reader Service number 481.

REVIEW

VHF/UHF MANUAL

Well, old chap, brew up a spot of tea and settle in your easy chair. The *VHF/UHF Manual* is here from the Radio Society of Great Britain, and quite a good read it is.

Edited by G.R. Jessop G6JP, this is the fourth edition of the manual, and it includes the latest in theory and circuits for the modern experimenter's paradise. The book runs to a healthy 528 pages, which is somewhat larger than the last edition. Subjects range from propagation to space communications, hitting tuned circuits, antennas, and test equipment along the way.

The authors begin the book with a germane point—that VHF/UHF communications is no longer the arcane art that most amateurs believe it to be. Indeed, they suggest that those frequencies provided the backbone of some of Marconi's earliest experiments, and that in 1924, the magnetron made 900-MHz oscillation possible.

By the '30s, the basic techniques for these frequencies had been developed, and since that time, the progress of solid-state equipment has provided a more comfortable environment for VHF/UHF experimentation. And with the proliferation of 2-meter equipment, there is no longer any excuse for amateurs not to know their way around the rarified atmosphere of 144 MHz and above.

The chapter on propagation leaves no stone unturned in its coverage of the odd twists and turns of VHF/UHF signals. Since propagation here is dependent on the troposphere rather than the ionosphere, meteorology comes into play when attempting to understand how the VHF signal travels. For those not familiar with the ways in which weather is studied, appropriate concepts such as dew point, adiabatic changes, and vapor pressure are explained, with particular attention paid to their effect on communications. The more bizarre forms of propagation—sporadic-E, meteor trail, and aurora—also are explained, using current theory.

Fortunately for the reader, the authors make frequent use of visual aids and include real-world examples. This is an attribute I noticed throughout the book. Drawings are frequently provided in conjunction with the schematics, providing better insight.

The manual is not all theory, however; in subsequent sections, some good old down-to-earth construction projects are described. The construction-oriented chapters make up the bulk of the book, and they cover receivers and transmitters, converters, filter, microwaves, and test equipment. The authors' selection of circuits runs a wide range, from timeout timers and simple tube converters to synthesized 2-meter equipment.

With the continent's generally more stringent regulations concerning EMI, the circuits cited in the manual are considered to be fairly clean designs. As a homebrewer, I was also concerned about the availability of foreign components used in the circuits. But most of those included in the manual use standard European nomenclature for transistors, and a conversion chart can quickly give you the US equivalent. And regardless of where you are, an Ohm is still an Ohm.

Other projects offered include SSB equipment, ATV signal processors, and 144-MHz amplifiers. 432-MHz gear is also well represented, but because of the European focus of the book, relatively few opportunities for the 220-MHz buff present themselves.

The manual's treatment of antennas, the last refuge of the experimenter on a budget, is equal parts theory and construction; some sound design parameters are offered, but you are not likely to find any radical departures from tradition here.

Space communications, which may prove to be this decade's mode (as 2-meter FM was in the '70s), has been

somewhat slighted as well. The manual has provided the basic information on understanding, tracking, and designing amateur satellites, but little about the nuts and bolts of designing your own satellite station. To their credit, the authors included up-to-date information on Phase III, and the rapidly changing face of satellite communications may have forced the authors to be sparing in their suggestions.

Moonbounce has been relegated to a mere two pages of text—which is exactly where it belongs, for few hams have the money, space, or time to fiddle with the demanding requirements of EME.

Overall, this book is a winner, whether you want to home-brew your own VHF/UHF gear or just understand what goes on inside your black box. And as proof positive that this book is in tune with the times, many of the old tube circuits have been left in. No contradiction here; according to the editor, tubes are about 100 times less susceptible to damage from EMP radiation—which is one of the by-products of an atomic explosion.

For more information, contact the *Radio Society of Great Britain, 35 Doughty St., London WC1N 2AE, England*. Reader Service number 488.

Avery L. Jenkins WB8JLG
73 Staff

GORDON WEST CODE TAPES

The concept of using tapes to teach the code is almost as old as the Morse code itself, and almost all of the variations of tape-taught code have been tried. I thought I had seen them all until I encountered Gordon West's Radio School code cassettes.

Gordon West WB4NOA has managed to come up with a new idea—his tapes are in stereo, with one channel consisting only of code and the other channel containing a voice translation of what is being sent. This is an interesting idea, particularly for the beginning student who needs to know if he is getting his characters straight.

The tapes I reviewed are for the first-time student who has no knowledge of the code. The four-tape series is divided into an equal number of 90-minute "modules," each representing a higher level of achievement (or difficulty, depending on how you look at it). The first two modules introduce the student to all of the letters, numbers, and punctuation marks in common usage. The remaining modules work toward reinforcing the previous lessons.

West begins lessons by introducing a few new characters, repeating them several times, and then sending a series of the new characters on one channel while identifying them in voice on the second channel. The purpose of the stereo is to allow you to listen to the code only and then go back and check your copy. Or, on your first round through that lesson, you can listen to both channels until you feel confident with the new characters being introduced.

Each lesson works gradually into more complex sequences. As more characters are introduced, the strings of letters become words and then sentences. The longer strings and sentences are not simultaneously translated on the voice channel. Instead, West identifies the end of each string with a period. This marker tells you to turn up the other channel for the voice translation of what was being sent.

Between lessons, West identifies possible trouble spots and offers tips to help beginners learn the code. From the sound and inflection of his voice, it is obvious that West has had broadcasting or announcing experience. His voice is easy to listen to and the script is delivered in an informal, chatty manner.

The tapes may also be played on a monaural system. The only difference will be that both channels will be played and you cannot blank out the voice-over as you can with a stereo cassette deck.

However, this compatibility with both mono and stereo systems is also one of the tapes' drawbacks. Since not all of the practice sessions are simultaneously repeated on the voice channel, the advantages of the stereo capability are not used to full advantage. Throughout much of the tape, the only difference between the West tapes and a standard mono tape is that you have to turn up the volume of one channel to catch the answers to the practice session.

After several hours of use on both stereo and mono tape players, I found that it was almost easier to listen to the tapes on the mono cassette player. The advantage to the separate channels occurs primarily when new letters are being introduced.

Another aspect of the West system which I did not like was the use of words and sentences. Unless random code groups are used, it becomes too easy to memorize the characters being sent rather than improve your recognition. After only a few trials on the tape, I could predict with fair accuracy the upcoming characters. Granted, I was not trying to learn the code at the same time, but the same process would occur at a slower rate with a beginning student.

West uses the standard system of teaching the code, beginning with the easiest characters such as i and e and progressing to the more difficult ones. Repetition—the key to successful memorization—is used to great advantage here. However, he does not send the characters themselves at a higher speed so that the student can get used to the sound of the code at 10 or 15 wpm. Time and again, it has been shown that this technique provides the best results because the student does not have to relearn the code each time he or she advances in speed.

I did not find that there were any clear advantages to West's stereo system. The tapes are professionally produced, and West has paid a lot of attention to the psychological factors of learning. His breaks are well-timed to coincide with the length of time most people can concentrate, and his informal manner to a certain extent overcomes the impersonality of tape-teaching.

But in his attempt to make the tapes compatible with both stereo and mono systems, West has somewhat weakened the effect of this novel technique.

West's code tapes list for $39.95 for a set of four. For more information, contact *Gordon West's Radio School, 2414 College Drive, Costa Mesa CA 92626; (714)-549-5000*. Reader Service number 486.

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73 Staff

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.

AEA'S KT-2 KEYER/TRAINER

OK, all you would-be General- and Extra-class hams out there—you no longer have any excuses for not upgrading. At least, not since the people at AEA came out with their KT-2 keyer/trainer. The KT-2 is a flexible unit which doubles as a code-practice device (CPO) and a keyer. In short, it will not quickly outlive its usefulness.

As quality equipment should be, the outside of AEA's little black box is deceptively simple, with only an on-off/volume knob and a DTMF keypad as external controls. On the back, there are jacks for headphones, a key, and outputs to either cathode-keyed or grid-keyed transceivers. However, the many capabilities of the KT-2 belie its plain appearance.

As a training unit, the KT-2 has several special features of note to the person trying to move his or her code speed up to that elusive 13 wpm. One of these features is the optional use of the Farnshaw method of practice.

The Farnshaw technique has proven to be one of the most successful ways of learning the code. More commonly known as "fast" practice, the Farnshaw style consists of sending the characters at a fast speed—say, 15 wpm—while maintaining a longer inter-character spacing to create a lower overall speed. In this way, the student does not have to relearn the sound of the characters as he advances in speed. You can, therefore, program the trainer to send its random code at 10 wpm, while keeping the character speed at 20 wpm. Actually, the trainer has the capability of sending from 5 wpm to 98 wpm, with a character speed of up to 99 wpm. Not too bad for a little black box.

AEA's KT-2 keyer/trainer.

Pumping Iron

Coupled with this option is the ability to program the keyer to automatically increase the code speed during a training session. I dubbed this the "pumping iron" technique since it parallels the method used by professional body-builders to develop muscles. On power-up, the trainer is set to start out at 5 wpm and accelerate to 20 wpm over 10 minutes; as workouts go, that's nothing to laugh at. But through the keypad, you can adjust both the starting and finishing speeds as well as the duration of the session.

More programming gives you further options. If you prefer the traditional method, hitting two keys on the pad will give you the code at exactly the speed you choose—no reduced intra-character spacing and no acceleration. Or if, like me, you prefer to listen to 20-wpm characters sent at 13 wpm with no speed-up to overload you, that can be arranged, too.

Randomize, Don't Memorize

Nine pseudorandom sequences may be chosen, and no sequence will repeat itself until about 34,000 characters have been sent. Even if you manage to memorize all of those without bringing your code speed up to where you want it, AEA has provided an escape valve. Starting a practice session with the ***# sequence will randomly select your starting point.

The length of word groups may be random or 5 characters per group. And if you really want to get tough on yourself, the KT-2 is divided into two character sets—a common set which includes the alphabet, numerals, and six frequently-used punctuation marks, and a second set which includes CW abbreviations and little-used punctuation. Those with an intense desire to copy apostrophes and parentheses won't be left out.

Though the sequences of keys you have to press to program and begin the trainer look complex, I found that I had them down pat after only a few sessions. None of the commands take more than four keystrokes, and AEA thoughtfully provides an easily-used table for quick reference.

Another advantage to using the KT-2 is that, unlike on-the-air practice, you don't have to guess at the speed. The KT-2 is calibrated to be extremely accurate, using the PARIS method. The word "PARIS" has 10 dots, four dashes, nine intra-character spaces, four inter-character spaces, and one word space for a total of 50 code elements. In adjusting code speed—for different dot-space and dash-space ratios—PARIS is used as a reference to determine the actual speed of the code.

The Keyer

The KT-2 is no contest keyer, but not all CW buffs are contesters—and as a keyer, the KT-2 offers you the options you need most.

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dash memories. The memories allow you to insert a dot in a string of dashes (or vice versa) just by squeezing the appropriate paddle. Without this feature, you would have to release the dash paddle, squeeze the dot paddle, and then key the dash side again. But if you prefer old-style sending, you can turn this option off.

And for tune-up, the keyer has a lock-on position which produces a solid tone while you fiddle with your finals. You can cancel the tone by hitting any button on the keypad.

The manual for the KT-2 is well-written. AEA provides an initial testing procedure to ensure that your unit is operating correctly, and the operating instructions are clear and concise. In addition, there is a complete schematic, parts list, and PC board layout. The unit uses a 12-V supply, and AEA sells a wall-plug adapter, a cigarette lighter cord, and a nicad pack to accompany it.

At the list price of $139.95, even Ted McElroy would have bought the KT-2.

For additional information, contact *Advanced Electronic Applications, PO Box C2160, Lynnwood WA 98036.* Reader Service number 487.

Avery L. Jenkins WB8JLG
73 Staff

CUSHCRAFT A3/A73 TRIBANDER

After years of helping to build (and use) other people's ham stations, I finally settled down and found a home that was compatible with ham radio. It didn't take long before a tower started growing in the backyard. No more semi-verticals and very random wires for me!

But having a tower meant that I had to find something to put on top of it—and monobanders were out (at least until next year!). I decided on the Cushcraft A3 triband beam with an A73 40-meter add-on kit. The A3 is a three-element beam for 10, 15, and 20 meters, and the A73 kit adds an additional set of traps and some length to the driven element so that the antenna will work as a rotatable dipole for 40 meters. With the A3/A73, I can cover four bands with one antenna and feedline, and that makes designing an antenna farm a lot easier.

The A3 is a small antenna with a boom length of only 14 feet, although the driven element (with the A73 kit installed) is about 35 feet long and uses a truss and cord to reduce element sag. The beam went together easily, and the instructions, which consist almost entirely of diagrams, were simple to follow. Element dimensions for use on the CW, phone, or mid-band segments are given so that the antenna can be tuned up in your favorite part of the band. I used the CW settings for mine.

The wind load of the A3/A73 is 4.94 square feet (4.63 sq. ft. if set up for 30 meters). The antenna is well built and should survive any reasonable wind.

After assembly, the crew (two on the ground and WA9SRW on the tower) hoisted the antenna up to its final resting place at 70 feet without any trouble. Some quick swr checks indicated that everything was as it should be, and off I went to work the world.

About a month after the A3 was installed, disaster struck. While operating with a kilowatt input on 20-meter CW, I watched with horror as the swr rose from its usual 1.1 to 1 up to 3 + to 1. After letting things cool down a bit, I tried again, this time using 100 Watts output. When first keyed, the swr was right where it should be, but I could watch it rise until, after about 45 seconds, it was back up to 3 to 1.

AG9V's stack: 2 × 7-el/146 MHz at 67', the Cushcraft A3 at 70', and home-brew Discone for 144/220/450 at 80'. (Photo by K9JQE)

A check of other bands showed that 40 meters also was affected, but that 10 and 15 meters were not. This led to the suspicion (confirmed by a phone call to Cushcraft) that I had a bad 40/20-meter trap on the driven element. Analyzing the failure, it appeared that there had been an arc in the trap. The failure occurred on a damp, misty night, and apparently the moist air provided the path that began the arc-over. Cushcraft whipped up a modified set of traps with increased clearances that should eliminate any such problems.

Once the weather cooperated and we got the new traps installed (these things always seem to happen in the middle of winter!), everything was back to normal. Subsequent misty nights have proven to be no problem. Cushcraft has informed me that these modifications will be used in future production A3/A73s.

Now for the $64,000 question—how does the A3 perform? Considering the compromises that are inevitable in a multiband beam, the answer is very well indeed.

Let's look at the compromises first. There are two problems with a small, trapped beam. First, traps aren't 100 percent efficient and they do introduce some loss, but more important, they shorten the elements by adding inductance to the antenna circuit. Of course, this has the advantage of creating a smaller antenna, but it also means that like most shortened antennas, the bandwidth will be reduced and the swr curve will be sharper.

Second, the spacing between elements is a compromise—if the elements aren't too widely spaced for 10 meters, they will be closely spaced for 20 meters. Closely-spaced elements tend to reduce gain, front-to-back ratio, and bandwidth.

Gain and front-to-back bandwidths usually get narrower along with swr bandwidth, and particularly on 20 meters, these measurements won't be near their peak values at the end of the band away from where the A3 is tuned.

These compromises most affect the lowest frequency band in use, and on the highest band, performance should be very close to that of a full-sized beam. In practical terms, the trade-offs don't make a tribander (or in this case, a "quadbander") like the A3 an inferior performer, and they certainly result in a very practical antenna design.

The A3's swr bandwidth, most noticeably on 20 and 40 meters, is much narrower than that of a full-sized antenna, and if the A3 is tuned for CW, you'd better figure on dealing with a rather high swr at the top of the phone band. On 40 meters, in fact, the 2 to 1 bandwidth is only about 125 kHz. Narrow swr bandwidth itself isn't a serious problem unless your rig won't load into the mismatch—and that's what antenna tuners are for. According to Cushcraft, the A3 will handle a full kW if the swr at the antenna (and not measured through a transmatch) is less than 3 to 1. An swr that high should occur only on 40 meters.

In use, the A3 isn't noticeably inferior to a full-sized antenna. The gain on 20 meters may be a dB or two below that of a monobander, but it's still a lot louder than a dipole! I spend most of my operating time haunting the bottom end of 20 CW, and I don't feel that the A3 is a handicap. If a pileup is so huge that I can't get through, it would take a lot more than a bigger antenna to make much difference.

My CW-tuned antenna does have lower gain and front-to-back ratio at the top of 20 than at the bottom. Setting the elements to mid-band dimensions would tend to even things out, but at some loss of CW performance. This is where the monobander has the edge, and where an operator demanding optimum performance across the entire band might be unhappy with the A3 or with any small tribander.

Of course, if you get into the battles on 20 phone or if you contest in a big way, you'll need all the antenna you can get, but I think that most of us can live quite nicely with an antenna like the A3—particularly when you consider the cost of an A3 and the modest tower it takes to support it versus the cost of a stack of monobanders, a huge rotor, and a heavy, guyed tower. That ultimate dB is very, very expensive!

I haven't talked to many folks who use a tribander with a 40-meter add-on, so I was very interested in how the A3/A73 would work for DXing from the midwest, a couple of thousand miles further from the DX than are you lucky coastal types. My other 40-meter antenna is a half-delta loop over a pretty good ground. It seems to work very well, and I've worked a fair amount of DX with it.

Well, folks, the A3/A73 beats the half-delta every time. It hears less noise and seems to talk as well or better than the other antenna. The nulls off the end of the rotatable dipole are very noticeable, and it is possible to null out European broadcasters by 10 to 20 dB merely by rotating the antenna 90 degrees away from Europe.

Of course, having the antennas at 70 feet doesn't hurt any, and at a lower height, the dipole might well lose to the half-delta. But in any installation, the A3/A73 has an advantage because it puts the 40-meter antenna up where it can perform best. It will nearly always be installed as high as it possibly can be, and unlike most wire dipoles, it will be in the clear and away from guy wires and other antennas. Under these conditions, a dipole can do an amazingly good job on the lower bands, particularly since fewer of the gang are using beams on 40 meters.

Incidentally, the A73 kit may also be set up to cover the new 30-meter band instead of 40, so it's an easy way to add a new band to your station without a lot of hassle if you already have an antenna for 40.

The A3/A73 antenna will provide respectable performance on 40 through 10 meters without unreasonable cost or complexity. It's a good choice for the ham who has limited space and/or funds for antennas, yet who wants to be able to punch through a pileup now and again.

For further information, contact *Cushcraft Corp., PO Box 4680/48 Perimeter Road, Manchester NH 03108.* Reader Service number 489.

John Ackermann AG9V
Green Bay WI

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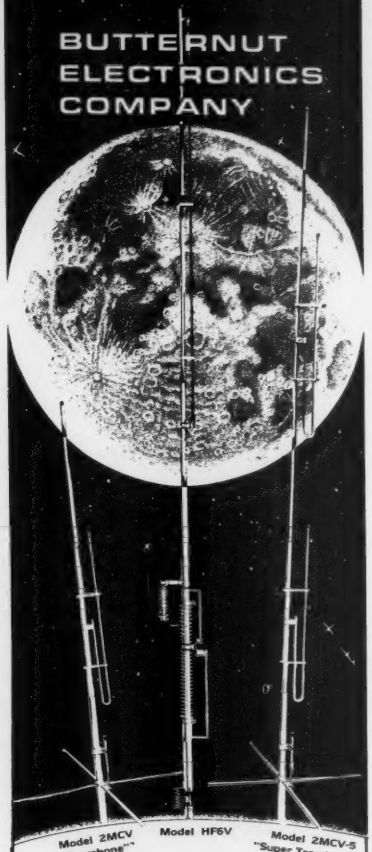

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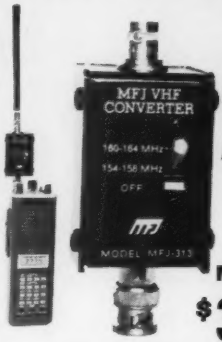

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

After all, what's the real difference? Radio waves go everywhere, so from a radio point of view, it is of little consequence whether the operator is in Burma, Thailand, or Sri Lanka. For that matter, one of the best DXpeditions of all time, Heard Island, was done from up near Vancouver, Canada. Just think of the trouble everyone was saved on that!

When you move the DXpedition nearer the US like that, you don't let propagation or distance screw up the contacts. You save a fortune on boat charges and have a much lower chance of getting killed. You save weeks of sailing, a bunch of gas, and in every way cut costs enormously. And your QSL cards are as valuable as if you'd gone to all that silly trouble and expense.

No, today's DXpeditioners seem to have lost their spark of originality and imagination. Poor Lloyd and Iris Colvin had to go through all sorts of trouble to get into the Persian gulf countries and get on the air. It cost 'em a bundle, too. And for what? Just to give a few thousand of us a card from a new country...one which would have been infinitely easier to get if they'd operated from some place nearer home. All you need is to make the contacts, provide some good-looking documentation to the ARRL, and thousands of hams are happy as clams.

The first truly imaginative DXpeditioner is still with us. I see him almost every year at Dayton. He set up and gave us contacts from a bunch of African countries while happily sitting in Casablanca. Once he broke the ice, we saw many of the previous DXpeditioning problems solved. That did away with quite a few arduous boat trips, eased country restrictions, eliminated customs problems for equipment, and so on.

Why take a chance on braving the wild South Atlantic storms when you can save tremendous time and keep out of danger by operating from near Venezuela? That's where a pair of well-known DXers did it. And, you know, it isn't much easier to blast through pileups to Peter and Paul Rocks if they have been moved, for convenience, to Venezuela instead of the Atlantic. Those same Texas and Missouri DXers are still in there tail-ending for twenty minutes, alternating calls so no one can tell if the DX station is transmitting or not.

I say let's get more fun into DXing by going back to the old system. Let's get a nice little DXpedition for Spratly going...with the spoilsport ARRL chaps who are making people get killed on the boat out of Singapore and the rest of us out on Catalina Island running two Watts to a wet string.

DIGITAL PERSPECTIVE

Having gotten bitten by the digital bug some 35 years ago when I got involved with amateur radio teletype, I haven't had as much trouble getting into the digital revolution as many of the more conservative (tube-oriented) old-timers. And now we're reading about the marvels of digital audio, the coming revolution in compact laser-playing disks...maybe even digital television.

As much of a fan of new ideas and pioneering as I am, I'm not yet totally convinced about the laser disk idea. The basic idea of digital audio is great. With this technology it's possible to make recordings where you have zero noise from the recording medium. Yep, no tape hiss...zero. No record groove hiss, snap, crackle, and pop. The idea is just fine. And the technology makes it possible to extend the dynamic range of recordings from 60 dB out to 90 dB. Remember, if you will, that every three dB means a doubling of power, so that extra 30 dB will buy you a thousandfold increase in power capability. Whooey, thousand-Watt audio amplifiers?

Digital audio has some benefits and some drawbacks. For the audiophile, the results of DA are so spectacular that he has no choice but to go digital. But this means a lot of expense, because while digital disk players will work with analog preamplifiers and amplifiers, a purist would blanch at anything less than digital right on through to the speaker. Digital speakers? No, little of this technology has even been invented yet, but it will be along. This will be a wonderful area for small entrepreneurs to get going, working toward starting megabuck corporations on the coattails of yet another budding high-tech industry.

The messy part of this whole scam lies in that vaunted laser disk. The problem is that we're way behind on inventing storage media for data. We're still horsing around with round, flat records which have to be spun...a hangover from the early recordings of Edison. You'd think we would get the message on this when we see $3,000 record players. And even those aren't as good as the early model laser digital players. Look at all the agonies we are going through with Winchester disks for data storage in computers! It's almost time to start seriously working on a mass memory system which is not mechanical.

They're talking about being able to put laser disk players into cars. It's laughable. Do you know that the silly record player they've invented to play those four-inch laser disks has to change speed as you go from the inside grooves to the outside from 600 rpm down to 200 rpm? And once you know that, you realize that the speed of the record player has to be different for every single groove it plays. Talk about a mechanical monster!

We may have to use some mechanics to retrieve data from a transportation medium, but spinning a record at an infinite number of speeds doesn't seem optimum. Perhaps we can come up with a card which can be read as it moves by a reader, using a memory cache to smooth out the flow of data. Or we might want to go to some sort of optical/film data storage system which might give us higher density of storage than micro holes blasted in thin films of metal.

On the bright side, there's no way that cassettes will be able to handle the data storage requirements, so we may see a drop in the copying of records.

These are wonderful days for amateurs...and we should remember that most of the really important breakthroughs in technology have historically been made by amateurs. If you've worked in any R&D firms, you know why this is as well as I...and I've done my homework on this one, too. I worked for an R&D lab at one time and saw with my own eyes why virtually no significant developments in technology can emerge.

The key lies in the funding process. R&D labs do not hire people to do what is called basic research...at least few of them do. Basic research is experimenting for the hell of experimenting, with no commercial product in mind. We used to spend a lot of money this way before WWII, but when the war came we stopped this "wasteful" spending and only worked on projects where there was a good potential for results.

It's still this way. If the lab manager is able to convince management that there is an almost certain chance for a profitable product to emerge, the research funds can be found. Iffy projects are tabled. The amateur, of course, with no one to stop him, can work on anything his heart desires. And if he comes up with something fantastic, he's got it made. If not, well, at least he's had the fun of trying. This is why hams in the past have come up with most of the real breakthroughs in radio technology.

It's getting time to experiment over the air with some digital audio. We might even want to try some digital stereo and see what we can do with it. A sampling rate of 10 kHz might work out fine for our type of communications rather than the 44 kHz they use for high-fidelity music. That's a little broad, but, after all, we're just experimenting. We might be able to get that down to 6 kHz and still have better voice communications than we have now.

The objective is to get a maximum of information through for a given band of frequencies and a given time, so whether we find it better to do with a 50-kHz-wide band or a 2-kHz band isn't as relevant as the throughput. If we can digitize voice and then send it in short blasts at high speed with error-correcting, we could end up with a very efficient communication medium.

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A piece in *Newsweek* a few weeks ago about a suit by Ron Hubbard's son to take over the Hubbard Scientology empire, claiming that no one has seen Hubbard for over two years and that he is presumed dead, brought to mind a recent rumor that DenTron had been bought by Scientology.

Having more than a casual interest in Hubbard and Scientology, I called DenTron to see what was up. Scientology has been getting a lot of flak of late, with exposés on television, books exposing it, and so on. Well, having been around when it began and having personally known Hubbard, I like to keep up with what's going on.

Scientology got started back in 1950 with the publication of an article in *Analog* magazine (science fiction). I'd been reading the magazine for many years and was particularly interested in an article on a new book being published by Hubbard on Dianetics, a new science of the mind. I got the book, started right in experimenting with some of the techniques described therein, and had some truly amazing experiences.

Hubbard's book was flamboyant and his claims extravagant, but since the fundamentals of it made more sense than any other approaches to the mind, I decided to look into it further. I took a six-week course at the Hubbard Dianetic Research Foundation in Elizabeth, New Jersey, and became an accredited Dianetic Auditor.

The school was fascinating. There was the element of baloney with the Hubbard claims of producing "clears" who had eidetic recall and were in most respects perfect people. We never saw anyone like that. But the concept was a good one and the techniques did produce the most incredible results in a hurry.

The story going around the school was that the whole idea for Dianetics was developed by someone else and that Hubbard had come across the manuscript for the work when the real author was in a hospital and died. So the claim went that Hubbard took the extensive research as his own, adding what he thought might result from the therapy—clears—as an accomplished fact.

Now Hubbard is, or was, a very magnetic person. He was a good writer and a persuasive BS artist. But the quick success of Dianetics seemed to distress him. It didn't take long before there were many people using the techniques from his book with more success than he enjoyed. Keeping in mind his enormous ego and the weight on him of the success of the therapy which he claimed to have discovered, I was not at all surprised when he came up with a new approach which was mostly his own...and which he called Scientology.

It's emotionally difficult to be a guru pretending something is your own when it isn't, so he came up with his own. This was cloaked as a religion, both as a way to get around laws against medical treatment by non-doctors and as a way of brainwashing the impressionable.

Having been at the HDRF, I remained on the Scientology mailing lists for years, getting their literature and receiving hundreds of letters suggesting I come in for updating. I kept answering all letters with the question: If you are able to really do such marvelous things, please show me one single example of a person who has been so improved by Scientology that he or she now stands out in some way over the rest of us. I never saw any indication that Scientology could even come close to Dianetics in effectiveness...and so no one seemed to emerge as outstanding in talents from the process.

Large numbers of Scientologists were used to write personal letters to prospective recruits. They had to write by hand... sincere...and encourage the correspondent to come in for a "test run."

One of the results of just about *any* type of mental therapy is the feeling that one has improved. Just as the sugar pill placebo given by doctors is capable of remarkable cures of some illnesses, the application of almost any psychotherapy seems to make some people feel better. Trading on this response, the Scientologists quickly get newcomers involved with their strange perception of reality, and they find it difficult to get loose.

Hubbard was able to build up his Church of Scientology into a multinational organization, with the headquarters at St. Hill, a huge estate in England. When governmental pressures from some countries grew too great, he moved his personal HQ to a converted cargo ship served by the elite of his group. I remember the glowing brochures asking for volunteers for this. Golly, the enthusiasm and excitement of those brochures was fun and almost too much to resist.

The church is now a large, rich organization with branches all over the world. And, I suspect, judging from the DenTron example, they are investing in businesses these days, not just in their own growth. I was assured by the president of DenTron that the Scientologist who had worked with them had recently left and that there was no more connection.

Getting back to Dianetics... I've kept in touch with most of the better known psychotherapies over the last thirty years and I know of none which works with the ease, speed, and thoroughness of Dianetics. I got to be quite good with the techniques involved and found that I was able to discover the roots of most problems people were having and could help them substantially in a matter of hours. But I also found that very few people really want to be helped. They've adjusted to some degree to their mental problems and are defensive about them.

Many of the basics of Dianetics were pooh-poohed by the establishment back in 1950, so it has been interesting for me to keep abreast of the development of these other schools of therapy and see them gradually accepting the very concepts which they found so totally ridiculous in 1950.

One of the basic concepts had to do with the way the brain ties up part of its ability to think when faced with a painful situation, either physical or mental. The most fundamental rule for any organism is to survive and thus pain signals are interpreted as a threat to survival. By deconditioning these painful moments in the past, we found that IQs increased and the ability to think zoomed upward.

Fortunately for our peace of mind, all of these pain memories and the subconscious responses they force upon us are carefully hidden from our conscious mind, with behavior, no matter how weird, rationalized.

Well, sorry for the usual digression, but I don't think I've ever written about Scientology or Dianetics before, and I suspect that very few people alive know about the possibly true roots of this amazing psychotherapy. And, yes, I'm familiar with Freudian analysis, the Karen Horney school, Gestalt psychology, Korzybsky, Examiner Therapy, Integration Therapy, and so on.

Did Hubbard come across the manuscript for Dianetics in a hospital in Burma during the war and pick it up from the dying real author? If Hubbard is dead, we may never know. But we do know that he was able to use that start to build a multi-billion dollar empire reaching around the globe.

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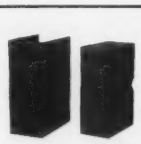

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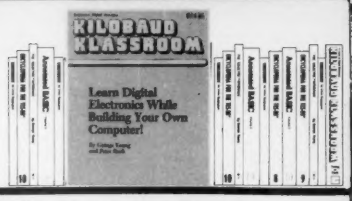

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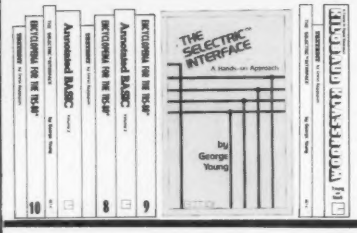

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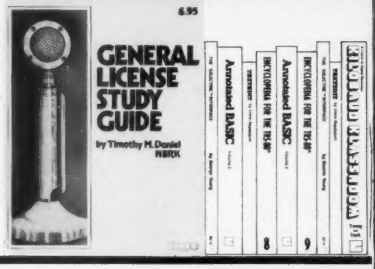

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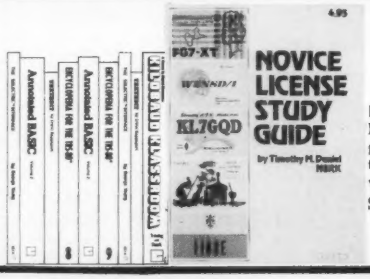

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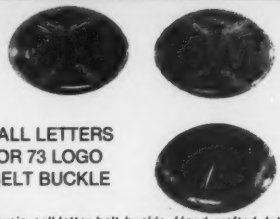

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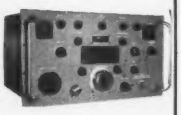

0.5 to 32 MHz in 32 bands. AM, CW, Tone FSK through use of BFO. IF selectivity 100 Hz to 16 kHz. Impedance 600 ohms. Power input 110/220 VAC, 50/60 Hz, single phase. Dimensions 12½ x 19 x 6½ inches. Weight 75 lbs. Used, good working condition. Includes partial manual reproduction.

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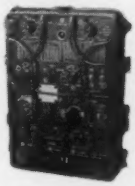

RT-77/GRC-9, portable 2-12 Mhz unit; 7 watts (AM), 15 W (CW) output. 2E22 tube in PA; 10 other tubes. Requires 580 V 100 ma, 6.6 V 2 amp, 120 V 45 ma, 1.5 V 500 ma, & 6.9 V 575 ma. 16x13x8", 35 lbs. sh. Used, **$39.95** MANUAL, **$8.50**; CONNECTORS, **$4** ea w/set purchase.

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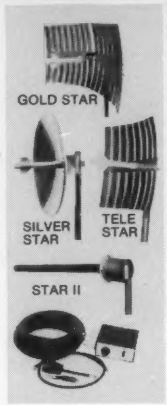

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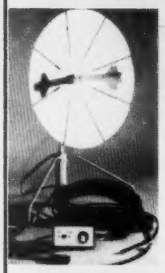

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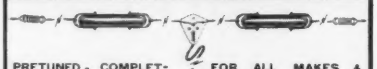

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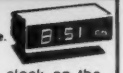

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A complete Satellite TV System requires a dish antenna, LNA (low noise amplifier), Receiver and Modulator.

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CDS Photocells

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See List of Advertisers on page 114

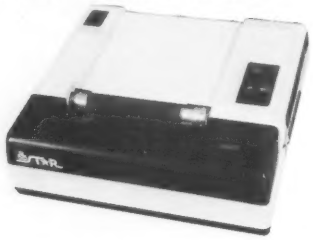
FACIT 4555 SERIAL PAGE PRINTER

The Facit 4555 alphanumerical serial printer is complete. Equipped with RS232C Interface, printing mechanism, control electronics, drive electronics, power supply and character generator. The adaptation electronics can be modified in four versions:Bit-parallel data transfer, CCITT (EIA, RS232C) for bit-serial data transfer and the current loop (TTY) interface also for bit serial data transfer. The Facit 4555 prints on ordinary paper and is adjustable for different paper widths and formats, 9.5" paper width with 66 lines per page or DIN A4 with 70 lines per page.

SPECIFICATIONS

Print speed	up to 60ch.s.	Char. spacing	2.54mm/1/10" 80ch/line 1.55mm/0.06" 132ch/line
Printing mode	Incremental.		
Max. # of ch/line	80 alt. 132.	Char. Code	ECMA-6 7-bit coded char. set
Matrix	7 X 5 dot matrix.	Char. Set	63 Char. various national versions.
Char. Size Height	2.7mm/1/8"		
Char. Size Width	1.3mm/0.05" 132ch/line 2.1mm/0.083" 80ch/line	Feed mechanism	Sprocket feed.

THESE UNITS WERE PULLED OUT OF SERVICE IN GOOD WORKING CONDITION. WE CHECK EACH UNIT ON A RADIO SHACK TRS-80 COLOR COMPUTER.



PRINTER ONLY $129.99

Printer with linecord, box of paper, inter-connect cable for TRS-80 COLOR COMPUTER. $149.99

GENEVA CALCULATOR WATCH

This attractive watch has the following modes:
Normal Time Setting,
Calendar Setting,
Daily Alarm Time Setting,
Weekly Alarm Time Setting,
Chronograph,
Calculator.

Featured in Black Plastic $24.99 or Featured in Stainless Steel $29.99

SILICON DIODES

MR751	100vdc	6Amps	10/$5.00	100/$38.00
MR510	1000vdc	3Amps	10/$3.75	100/$24.00
HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
275Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

FAIRCHILD 4116 16K DYNAMIC RAMS 200ns. Part # 16K75

25 For $25.00 or 100 For $90.00 or 1000 For $750.00

FEED THRU SOLDER RF CAPACTORS

470pf +-20%

5/$1.00 or 100/$15.00 or 1000/$100.00

1000pf/.001uf +-10%

4/$1.00 or 100/$20.00 or 1000/$150.00

E PROMS

2708 1024x1	$2.00 each
2716 2048x8	$4.00 each
27L32/25L32	$10.00 each

HEWLETT PACKARD MICROWAVE DIODES

1N5711	(5082-2800)	Schottky Barrier Diodes	$1.00 or 10 for $ 8.50
1N5712	(5082-2810)	" " "	$1.50 or 10 for $10.00
1N6263	(HSCH-1001)	" " "	$ .75 or 10 for $ 5.00
5082-2835		" " "	$1.50 or 10 for $10.00
5082-2805	Quad Matched	" " "	per set $5.00 or 10 for $40.00

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"MIXERS"

WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min F=2GHz dB 2.4 Typ. MAG F=2GHz dB 12 Typ. $5.30
F=3GHz dB 3.4 Typ. F=3GHz dB 9 Typ.
F=4GHz dB 4.3 Typ. F=4GHz dB 6.5 Typ.

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacturers, and described in the RF Data Book.

5pf	10pf	18pf	30pf	43pf	100pf	200pf	1 to 10pcs. $1.00 ea
5.1pf	12pf	22pf	32pf	51pf	110pf	220pf	11 to 50pcs. $ .90 ea
6.8pf	13pf	25pf	33pf	60pf	120pf	470pf	51 up pcs. $ .80 ea
7pf	14pf	27pf	34pf	80pf	130pf	500pf	
8.2pf	15pf	27.5pf	40pf	82pf	140pf	1000pf	

NIPPON ELECTRIC COMPANY TUNNEL DIODES

		MODEL 1S2199	1S2200 $7.50
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
Projected Peak Pt. Voltage mv.	Vpp Vf=Ip	480min. 550Typ. 630max.	440min. 520Typ. 600max.
Series Res. Ohms	rS	2.5Typ. 4max.	2Typ. 3max.
Terminal Cap. pf.	Ct	1.7Typ. 2max.	5Typ. 8max.
Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ratio (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

Listsall Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

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RF TRANSISTORS, MICROWAVE DIODES

PART	PRICE
1S2199	$ 7.50
1S2200	7.50
2N1561	25.00
2N1562	25.00
2N2857	1.55
2N2857JAN	2.55
2N2876	11.00
2N2947	18.35
2N2948	15.50
2N2949	3.90
2N2950	4.60
2N3375	8.00
2N3553	1.57
2N3632	13.80
2N3818	5.00
2N3866	1.30
2N3924	3.35
2N3927	17.75
2N3950	25.00
2N4072	1.80
2N4127	21.00
2N4427	1.30
2N4428	1.85
2N4957	3.45
2N4958	2.90
2N4959	2.30
2N5090	13.90
2N5108	4.00
2N5109	1.70
2N5160	3.45
2N5177	21.62
2N5179	1.00
2N5583	4.00
2N5589	8.65
2N5590	10.35
2N5591	13.80
2N5635	10.95
2N5637	15.50
2N5641	9.20
2N5642	10.95
2N5643	15.50
2N5645	13.80
2N5646	20.70
2N5691	18.00
2N5764	27.00
2N5836	5.45
2N5842	8.00
2N5849	20.00
2N5913	3.25
2N5922	10.00
2N5923	25.00
2N5941	23.00
2N5942	40.00
2N5944	9.20
2N5945	11.50
2N5946	19.00
2N6080	9.20
2N6081	10.35
2N6082	11.50

PART	PRICE
2N6083	$ 13.25
2N6084	15.00
2N6094 /M9622	11.00
2N6095 /M9623	12.00
2N6096 /M9624	15.50
2N6097	17.25
2N6136	21.85
2N6166	40.25
2N6201	50.00
2N6459	18.00
2N6603	12.00
2N6680	80.00
2SC756A	7.50
2SC781	2.80
2SC1018	1.00
2SC1042	12.00
2SC1070	2.50
2SC1239	2.50
2SC1251	12.00
2SC1306	2.90
2SC1307	5.50
2SC1760	1.50
2SC1970	2.50
2SC2166	5.50
8B1087 (M.A.)	25.00
A50-12	20.00
A283B	5.00
ALD4200N (AVANTEK)	395.00
AM123	97.35
AM688	100.00
BB105B	.52
BD4/4JFBD4 (G.E.)	10.00
BFQ85	1.50
BFR90	1.30
BFR91	1.65
BFW92	1.50
BFX89	1.00
BFY90	1.00
BGY54	25.00
BGY55	25.00
BGY74	25.00
BGY75	25.00
BL161	10.00
BLX67	11.00
BLY568CF	25.00
BLY87	13.00
BLY88	14.00
BLY89	15.00
BLY90	20.00
BLY351	10.00
C4005	20.00
CA402 (TRW)	25.00
CA405 (TRW)	25.00
CA612B (TRW)	25.00
CA2100 (TRW)	25.00
CA2113 (TRW)	25.00
CA2200 (TRW)	25.00
CA2213 (TRW)	25.00
CA2418 (TRW)	25.00

PART	PRICE
CA2612 (TRW)	$ 25.00
CA2674 (TRW)	25.00
CA2881-1(TRW)	25.00
CA4101 (TRW)	25.00
CA4201 (TRW)	25.00
CA4600 (TRW)	25.00
CD1889	20.00
CD2545	20.00
CMD514AB	20.00
D4959	10.00
D4987M	20.00
D5147D	10.00
D5506	10.00
D5827AM	20.00
DMD6022	30.00
DMS-2A-250	40.00
HEP76	4.95
HEPS3002	11.30
HEPS3003	30.00
HEPS3005	10.00
HEPS3006	19.90
HEPS3007	25.00
HEPS3010	11.34
HTEF2204 H.P.	112.00
5082-0112 H.P.	14.20
5082-0253 H.P.	105.00
5082-0320 H.P.	58.00
5082-0386 H.P.	POR
5082-0401 H.P.	POR
5082-0438 H.P.	POR
5082-1028 H.P.	POR
5082-2711 H.P.	23.15
5082-3080 H.P.	2.00
5082-3188 H.P.	1.00
5082-6459 H.P.	POR
5082-8323 H.P.	POR
35826E H.P.	POR
35831E H.P.	29.99
35853E H.P.	71.50
35854E H.P.	75.00
HPA0241 H.P.	75.60
HXTR3101 H.P.	7.00
HXTR3102 H.P.	8.75
HXTR6101/2N6617 H.P.	55.00
HXTR6104 H.P.	68.00
HXTR6105 H.P.	31.00
HXTR6106 H.P.	33.00
QSCH1995 H.P.	POR
JO2000 TRW	10.00
JO2001 TRW	25.00
JO4045 TRW	25.00
K3A	10.00
MA450A	10.00
MA41487	POR
MA41765	POR
MA43589	POR
MA43636	POR
MA47044	POR
MA47651	25.50

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GaAs, TUNNEL DIODES, ETC.

PART	PRICE
MA47100	$ 3.05
MA47202	30.80
MA47771	POR
MA47852	POR
MA49558	POR
MB4021	POR
MBD101	1.00
MDO513	POR
MHW1171	42.50
MHW1182	48.60
MHW4171	49.35
MHW4172	51.90
MHW4342	68.75
MLP102	25.00
MM1500	32.32
MM1550	POR
MM1552	50.00
MM1553	50.00
MM1614	10.00
MM2608	5.00
MM3375A	11.50
MM4429	10.00
MM8000	1.15
MM8006	2.30
MO277L	POR
MO283L	POR
MO3757	POR
MP102	POR
MPN3202	10.00
MPN3401	.52
MPN3412	1.00
MPSU31	1.01
MRA2023-1.5 TRW	42.50
MRF212/208	16.10
MRF223	13.25
MRF224	15.50
MRF237	3.15
MRF238	12.65
MRF243	25.00
MRF245	34.50
MRF247	34.50
MRF304	43.45
MRF315	23.00
MRF420	20.00
MRF421	36.80
MRF422	41.40
MRF427	16.10
MRF428	46.00
MRF450/A	13.80
MRF453/A	17.25
MRF454/A	19.90
MRF455/A	16.00
MRF458	19.90
MRF463	25.00
MRF472	1.00
MRF475	2.90
MRF477	11.50
MRF502	1.04
MRF503	$ 6.00
MRF504	7.00
MRF509	5.00
MRF511	8.65
MRF605	20.00
MRF629	3.47
MRF644	23.00
MRF816	15.00
MRF823	20.00
MRF901	3.00
MRF8004	2.10
MS261F	POR
MT4150 Fair.	POR
MT5126 Fair.	POR
MT5481 Fair.	POR
MT5482 Fair.	POR
MT5483 Fair.	POR
MT5596 Fair.	POR
MT5764 Fair.	POR
MT8762 Fair.	POR
MV109	.77
MV1401	8.75
MV1624	1.42
MV1805	15.00
MV1808	10.00
MV1817B	10.00
MV1863B	10.00
MV1864A	10.00
MV1864B	10.00
MV1864D	10.00
MV1868D	10.00
MV2101	.90
MV2111	.90
MV2115	1.55
MV2201	.53
MV2203	.53
MV2209	2.00
MV2215	2.00
MWA110	7.45
MWA120	7.80
MWA130	8.25
MWA210	7.80
MWA220	8.25
MWA230	8.65
MWA310	8.25
MWA320	8.65
MWA330	9.50
NEC57835	5.30
ON382	5.00
PPT515-20-3	POR
PRT8637	POR
PSCQ2-160	POR
PT3190	POR
PT3194	POR
PT3195	POR
PT3537	POR
PT4166E	POR
PT4176D	POR
PT4186B	$ POR
PT4209	POR
PT4209C	POR
PT4566	POR
PT4570	POR
PT4571	POR
PT4571A	POR
PT4577	POR
PT4590	POR
PT4612	POR
PT4628	POR
PT4640	POR
PT4642	POR
PT5632	POR
PT5749	POR
PT6612	POR
PT6626	POR
PT6709	POR
PT6720	POR
PT8510	POR
PT8524	POR
PT8609	POR
PT8633	POR
PT8639	POR
PT8659	POR
PT8679	POR
PT8708	POR
PT8709	POR
PT8727	POR
PT8731	POR
PT8742	POR
PT8787	POR
PT9790	41.70
PT31962	POR
PT31963	POR
PT31983	POR
PTX6680	POR
RAY-3	24.99
40081	POR
40281	POR
40282	POR
40290	POR
RF110	25.00
SCA3522	POR
SCA3523	POR
SD1065	POR
SS43	POR
TP1014	POR
TP1028	POR
TRW-3	POR
UTO504 Avantek	70.00
UTO511 Avantek	75.00
V15	4.00
V33B	4.00
V100B	4.00
VAB801EC	25.00
VAB804EC	25.00
VAS21AN20	25.00

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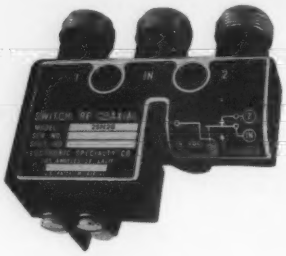
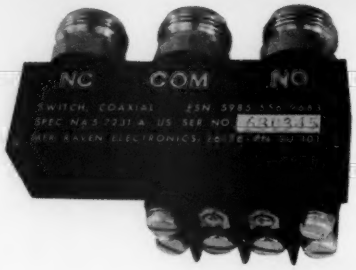
COAXIAL RELAY SWITCHES SPDT

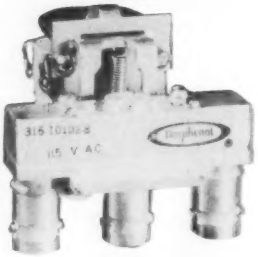
Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.





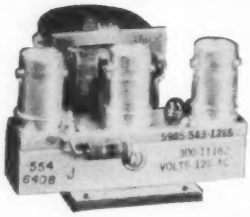
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



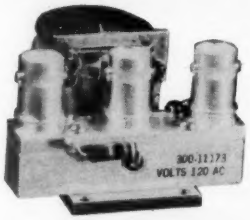
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00

$8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

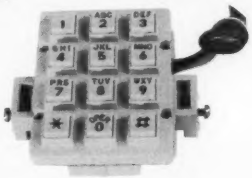
The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

TOUCH TONE PAD

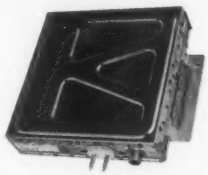
This pad contains all the electronics to produce standard touch-tone tones. New with data.



$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUIT.		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.
Features:
1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TUBES

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2E26	$ 5.69	KT88	$ 20.00	6562/6974A	$ 50.00
2K28	100.00	DX362	50.00	6832	22.00
2X1000A	300.00	DX415	50.00	6883/8032A/8552	7.00
3B22	19.75	572B/T160L	49.00	6897	110.00
3B28/866A	7.50	592/3-200A3	144.00	6907A	75.00
3-500Z	102.00	807	7.50	6939	15.00
3-1000Z	400.00	811	10.00	7094	125.00
3CX1000A/8283	428.00	811A	15.00	7117	17.00
3CX1500A7/887	533.00	812A	35.00	7211	60.00
3X2500A3	200.00	813	50.00	7289/3CX100A5	34.00
3CX3000A7	490.00	829B	38.00	7360	11.00
4-65A/8165	45.00	832A	28.00	7377	67.00
4-125A/4D21	58.00	4624	310.00	7408	4.00
4-250A/5D22	75.00	4662	80.00	7650	250.00
4-400A/8432	90.00	4665	585.00	7695	8.00
4-400C/6775	95.00	5675/A	25.00	7843	58.00
4-1000A/8166	300.00	5721	200.00	7854	83.00
4B32	22.00	5768	85.00	7868	5.00
4E27A/5-125B	155.00	5836	100.00	7894	12.00
4CS250R	146.00	5837	100.00	8072	65.00
4X150A/7034	30.00	5861/EC55	110.00	8117A	130.00
4X150D/7035	40.00	5876A	25.00	8121	60.00
4X150G/8172	100.00	5881/6L6W	6.00	8122	100.00
4X250B	30.00	5893	45.00	8236	30.00
4CX250B/7203	45.00	5894/A	50.00	8295/PL172	506.00
4CX250F/G/8621	55.00	5894/B	60.00	8462	100.00
4CX250K/8245	100.00	5946	258.00	8505A	73.50
4CX250R/7580W	69.00	6080	10.00	8533W	92.00
4CX300A/8167	140.00	6083/AX9909	89.00	8560/A	65.00
4CX350A/8321	83.00	6098/6AK6	14.00	8560AS	90.00
4CX350F/J/8904	95.00	6115/A	110.00	8608	34.00
4X500A	282.00	6146	7.00	8637	38.00
4CX600J/8809	607.00	6146A	7.50	8643	100.00
4CW800F	625.00	6146B/8298A	8.50	8647	123.00
4CX1000A/8168	340.00	6146W	14.00	8737/5894B	60.00
4CX1500B/8660	397.00	6156	66.00	8873	260.00
4CX5000A/8170	932.00	6159	15.00	8874	260.00
4CX10000D/8171	990.00	6161	233.00	8875	260.00
4CX15000A/8281	1260.00	6291	125.00	8877	533.00
4PR60A	100.00	6293	12.00	8908	12.00
4PR60B/8252	175.00	6360	5.00	8930/651Z	71.00
4PR400A/8188	192.00	6524	53.00	8950	12.00
5CX1500A	569.00	6550	10.00		
6BK4C	6.00	6JM6	6.00	6LQ6 (Sylvania)	7.50
6DQ5	5.00	6JN6	6.00	6LU8	6.00
6FW5	6.00	6JS6B	6.00	6LX6	6.00
6GE5	6.00	6KG6/EL505	6.00	6ME6	6.00
6GJ5	6.00	6KM6	6.00	12BY7A	4.00
6HS5	6.00	6KN6	6.00	12JB6A	6.00
6JB5/6HE5	6.00	6LF6	6.00	6KD6	6.00
6JB6A	6.00	6LQ6 (GE)	6.00	6JT6A	6.00
				6KD6	6.00

NOTICE ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE !!!!

"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO, Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FBC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

SPECTRA PHYSICS INC, Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS
105CFM at 60CPS THESE ARE NEW $ 7.99

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HEWLETT PACKARD SIGNAL GENERATORS

606A	50KHz to 65MHz in 6 bands +-1%,Output level adjustable 0.1uV to 3V into 50 ohms.Built-in crystal calibrator.400 -1000Hz modulation.	$ 650.00
606B	Same as above but has frequency control feature to allow operation with HP 8708A Synchronizer.	$1100.00
608C	10MHz to 480MHz,0-1uV-1V into 50 ohms,AM,CW,or pulse modulation, calibrated attenuator.	$ 500.00
608D/ TS510	10MHz to 420MHz, 0.1uV-0.5V into 50 ohms,+-0.5% accuracy, built-in crystal calibrator, AM-CW or pulse output.	$ 375.00
608E	Improved version of popular 608C.Up to 1V output.Improved stability,low residual FM.	$1450.00
608F	10MHz to 455MHz in 5 bands +-1% frequency accuracy with built-in crystal calibrator.Can be used with HP 8708A Synchronizer. Output continuously adjustable from .1uV to .5V into 50 ohms.	$1100.00
612A	450-1230MHz ,0.1uV-0.5V into 50 ohms,calibrated output.	$ 750.00
614A	900-2100MHz with many features including calibrated output and all modulation characteristics.	$ 500.00
616A/ TS403	Direct reading and direct control from 1.8 to 4.2GHz. The H.P.616A features +-1.5dB calibrated output accuracy from -3127dBm to -dBm.The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation frequency dial accuracy is +-1% and stability exceeds 0.005%-/ C change in ambient temperature. Calibrated attenuator is within +-1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4KHz,variable pulsewidth(1 to 10usec)and variable pulse delay(3 to 300usec).External modulating inputs increas versatility.	$ 375.00
616B	Same as above but later model.	$ 600.00
618B	3.8 to 7.6GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 600.00
618C	Same as above but later model.	$2200.00
620A	7 to 11GHz range,with calibrated output and selection of pulse-FM or square wave modulation.	$ 750.00
620B	Same as above but later model.	$2200.00
626A	10 to 15GHz,10mw output power with calibrated output and pulse-square wave or FM modulation.	$4200.00
8708A	Synchronizer used with 606B,608F.The synchronizer is a phase-lock frequency stabilizer which provides crystal-oscillator frequency stability to 430MHz in the 608F signal generator.Phase locking eliminates microphonics and drift resulting in excellent frequency stability.The 8708A includes a vernier which can tune the reference oscillator over a range of +-0.25% permitting frequency settability to 2 parts in 10 to the seventh.Provides a very stable signal that satisfies many critical applications.	(With HP 606B or 608F) $ 350.00 (Without) $ 450.00
EMC-10	ELECTROMETRICS EMC-10 RFI/EMI RECEIVER Low frequency analyzer covering 20Hz to 50KHz frequency range.Extendable to 500 KHz in wideband mode.	$2500.00
NF-105F	Empire Devices Field Intensity Meter. Has NF-105/TA,NF-105/TX,NF-105/T1,NF-105/T2,NF-105/T3. Covers 14KHz to 1000MHz.	$2100.00

ALL EQUIPMENT CARRY A 30 DAY GUARANTEE.

EQUIPMENT IS NOT CALIBRATED.

ORDERING INSTRUCTIONS

DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

HOURS: Monday thru Saturday: 8:30 a.m. to 5:00 p.m.

INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, United Parcel only.

ORDER FORMS: New order forms are included with each order for your convenience. Additional forms are available on request.

POSTAGE: Minimum shipping and handling in the US, Canada, and Mexico is $2.50 all other countries is $5.00. On foreign orders include 20% shipping and handling.

PREPAID ORDERS: Order must be accompanied by a check.

PRICES: Prices are subject to change without notice.

RESTOCK CHARGE: If parts are returned to MHZ Electronics due to customer error, customer will be held responsible for all extra fees, will be charged a 15% restocking fee, with the remainder in credit only. All returns must have approval.

SALES TAX: Arizona must add 5% sales tax, unless a signed Arizona resale tax card is currently on file with MHZ Electronics. All orders placed by persons outside of Arizona, but delivered to persons in Arizona are subject to the 5% sales tax.

SHORTAGE OR DAMAGE: All claims for shortages or damages must be made within 5 days after receipt of parcel. Claims must include our invoice number and the date of purchase. Customers which do not notify us within this time period will be held responsible for the entire order as we will consider the order complete.

OUR 800 NUMBER IS STRICTLY FOR ORDERS ONLY
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FOREIGN: Prepaid only, U.S. Funds—money order or cashier's check only.

C.O.D.: Acceptable by telephone or mail. Payment from customer will be by cash, money order or cashier's check. We are sorry but we cannot accept personal checks for C.O.D.'s.

CONFIRMING ORDERS: We would prefer that confirming orders not be sent after a telephone order has been placed. If company policy necessitates a confirming order, please mark "CONFIRMING" boldly on the order. If problems or duplicate shipments occur due to an order which is not properly marked, customers will be held responsible for any charges incurred, plus a 15% restock charge on returned parts.

CREDIT CARDS: WE ACCEPT MASTERCARD VISA AND AMERICAN EXPRESS.

DATA SHEETS: When we have data sheets in stock on devices we do supply them with the order.

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↙48

↙See List of Advertisers on page 114

NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.

Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39.95
LNA 50	40-70	0.9 dB	20 dB	$39.95
LNA 144	120-180	1.0 dB	18 dB	$39.95
LNA 220	180-250	1.0 dB	17 dB	$39.95
LNA 432	380-470	1.0 dB	18 dB	$44.95

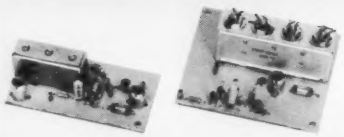
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $14.95
- P30C, VHF Kit with case $20.95
- P30W, VHF Wired/Tested $29.95
- P432K, UHF Kit less case $18.95
- P432C, UHF Kit with case $24.95
- P432W, UHF Wired/Tested $33.95

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49.95
HRA-220	213-233 MHz	$49.95
HRA-432	420-450 MHz	$59.95

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
Kit $44.95	50-52	28-30
Less Case $39.95	50-54	144-148
Wired $59.95	144-146	28-30
	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
Kit $54.95	435-437	28-30
Less Case $49.95	432-436	144-148
Wired $74.95	432-436	50-54
	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

SPECIAL FREQUENCY CONVERTERS made to custom order $119.95. Call for details.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

FM-5 PC Board Kit – **ONLY $159.95** complete with controls, heatsink, etc. 10 Watts, 5 Channels, for 6M, 2M, or 220

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $59.95

REPEAT OF A SELLOUT!

While supply lasts, get $59.95 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $159.95?

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 watts output.

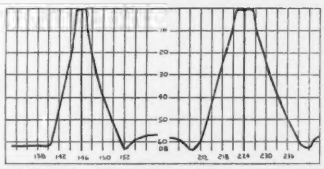
	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79.95	28-30	50-52
Wired $119.95	27-27.4	144-144.4
(Specify band)	28-30	220-222
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99.95	50-54	432-436
Wired $149.95	61.25	439.25
	144-148	432-436*

*Add $35 for 2M input

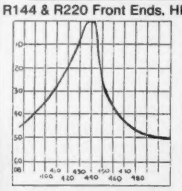
FREE OFFER

For limited time, buy a transmit converter above with 40-45W PA ($129.95) and get $39.95 cabinet FREE.

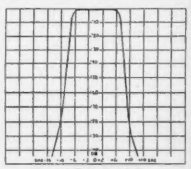
LOOK AT THESE ATTRACTIVE CURVES!



R144 & R220 Front Ends, HRA 144/220, & HRF-144/220

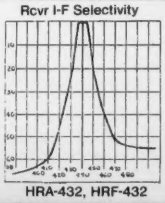


R451 Receiver Front End



Rcvr I-F Selectivity

Typical Selectivity Curves of Receivers and Helical Resonators.



HRA-432, HRF-432

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- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
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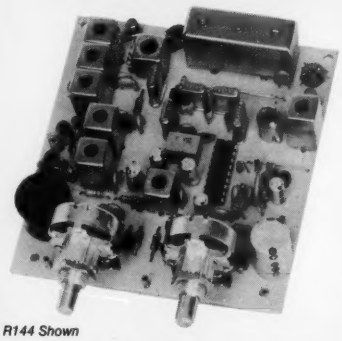

R144 Shown

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity (curves at left). AFC incl., xtal oven avail. Kit only $119.95
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $119.95.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $109.95. Also avail w/4 pole filter, only $94.95/ kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $84.95
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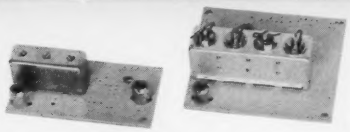
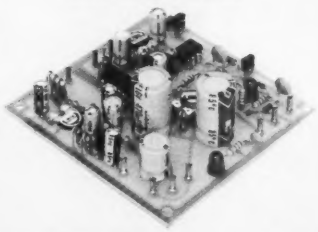


- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

  HRF-144 for 143-150 MHz $34.95
  HRF-220 for 213-233 MHz $34.95
  HRF-432 for 420-450 MHz $44.95

  (See selectivity curves at left.)



- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $89.95.
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $89.95. Requires DTMF Module.
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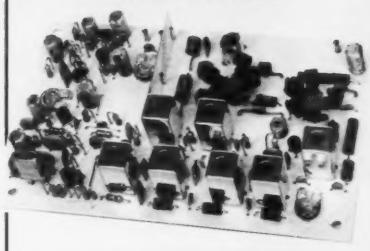

- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $59.95

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $69.95.
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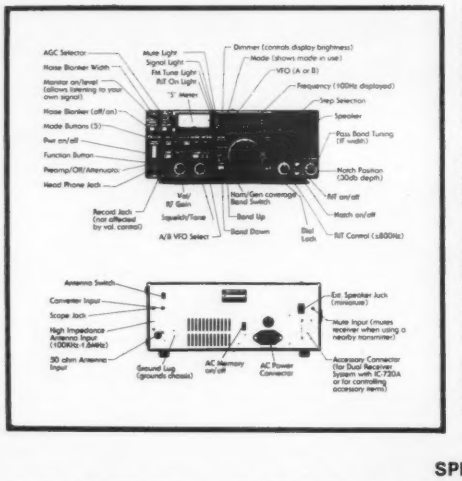

Spectronics is proud and excited to announce ICOM's long rumored and awaited professional general coverage receiver, the IC-R70.

It features more functions than other less sophisticated general coverage receivers on the market; features that the serious shortwave listener or ham operator would want, such as squelch on sideband, adjustable width noise blanker, adjustable speed AGC, passband tuning as standard, and adjustable notch filter as standard.

Other convenient features are high stability, synthesized tuning and 3 tuning speeds, optional AM/FM mode, variable CW filter widths, dial lock, two VFO's with data transfer, plus many others. Also, the IC-R70 will operate transceive with the IC-720A, making an ideal combination for the serious DX'r or CW buff.

GENERAL COVERAGE RECEPTION AT ITS BEST Listen to the world of HF with the R70, a 100KHz to 30MHz commercial grade receiver designed by ICOM Incorporated, the leader in advanced receiver design. Built from knowledge gained by designing receivers for commercial, marine, and amateur use, the R70 surpasses other receivers on the market...even receivers costing more than twice as much.

Utilizing ICOM's DFM (Direct Feed Mixer), the R70 is a receiver which in normal usage is virtually immune to intermodulation distortion or cross modulation, yet still maintains superior sensitivity. Whether you are a Short Wave Listener, Amateur Radio Operator, Maritime operator or commercial user, the R70 provides the features you need.

DESIGN The R70 incorporates an UP conversion system, utilizing a direct feed mixer proven to be the best design for minimizing interference from strong adjacent signals. A preamp is provided for making the weakest of signals readable. High grade filters in conjunction with the built-in PBT (pass band tuning) system and notch filter, provide the ultimate in interference rejection. Selectable AGC (fast/slow/off), noise blanker (wide or narrow), and tone control improve readability under the worst conditions. An AGC derived squelch, operative in all modes, adds to operating ease.

Dual VFO's with three tuning rates provide quick QSY (frequency change), memory for an important station, or by equalizing the VFO's (A = B), a digital RIT. 13.8 VDC operation is provided as an option, 117 VAC is standard.

SWL — For the short wave listener, the readout section of the R70 gives all the information for logging a station to be returned to at a later time. Frequency, mode, VFO, signal strength are all displayed. A dial lock prevents accidental loss of a signal.

A front mounted speaker provides 3 watts of crisp clear audio. A record jack allows easy attachment of a tape recorder.

SPECIFICATIONS

Frequency Coverage: 100KHz - 30MHz. **Receiving Modes:** SSB (A3J), CW(A1), RTTY(F1), AM(A3), *FM(F3). **Receiver Type:** SSB, CW, RTTY, AM - double conversion superhetrodyne. *FM - Triple conversion. **IF Frequencies:** 1st - 70.4515MHz. 2nd - SB - - - 9.0115MHz, CW, RTTY - 9.0106MHz, AM, *FM - 9.0100MHz. PBT - 455KHz. 3rd p *FM -455KHz. **Sensitivity:** SSB, CW, RTTY - 0.16uV for 10 dB S/N (100KHz-1.6MHz = 1uV for 10 dB S/N). AM - 0.5uV for 10 dB S/N. *FM - 0.32uV for 12 dB SINAD (1.6 - 30 MHz only). **Selectivity: SSB, CW, RTTY:** 2.3 KHz @ -6dB/4.2KHz @-60dB. **CW-N, RTTY-N:** 500 Hz @ -6dB/1.5 KHz @ -60dB. **AM:** 6KHz @ -6dB/18KHz @ -80dB. **FM:** 15KHz @ -6dB/25KHz @ -60dB. **Stability:** ±500Hz over -10° to +60°C, ±250Hz from 1 min. to 1 hr. after turn on, ±50 Hz thereafter. **Spurious Responses:** -60dB down. **Dynamic Range:** 100 dB @ 500Hz IF Bandwidth. **PBT Range:** SSB, CW, RTTY ± 1.8 KHz AM ±3.3KHz. **RIT Range:** ±800 Hz from center position. **Notch Depth:** 30dB. **Audio Power:** 3 watts into 8 ohms with 10% distortion (5.8 watts into 4 ohms). **Power Supply:** Built in AC type for 100, 117, 220 to 240 volts ± 10% (50/60 Hz), 13.8V ±15% DC supply capability optional. **Weight:** 16.28 lbs. **Size:** 11.25 (11.92)"W x 4.33(5.0)"H x 10.86(12.56)"D. **Antenna Impedance:** 50 ohms (100KHz - 1.6MHz a long wire is used - terminal is provided). **Ground:** Chassis is at ground potential, ground lug provided. **Power Consumption:** AC, Volume minimum 24VA (20W); AC, Volume max. 30VA (25W), DC, Volume min. 0.7A; DC, Volume max. 1.0A. **Operating Temperature Range:** -10° to +60°C.

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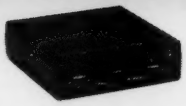


9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

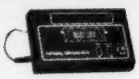
SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95



7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
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COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

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J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7A	7	14	14	14	21	21A	21
AUSTRALIA	21	14A	14	14B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14	14	7	7	7	14	14	14	14	21	21
ENGLAND	14	7A	7	7	7	7A	14	14	14A	14A	14	14
HAWAII	14A	14A	14	7	7B	7B	7	7	14	14	14	14
INDIA	14	14	14B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14	14	14B	7B	7B	7B	7	14	14	14	14	14
MEXICO	14A	14	14	7A	7	7	7A	14	14	14	21	14A
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	14A	14	14	7	7	7	14	14	14	14A	14A	14A
SOUTH AFRICA	7B	7B	7B	7A	14	14	14A	14A	21	21	14	14B
U. S. S. R.	7A	7A	7	7	7	7A	14	14	14	14	14	14
WEST COAST	14A	14	14	7	7	7	7	14	14	14A	14A	14A

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7A	7	7A	14	14	21	21A	21
AUSTRALIA	21	14A	14	14B	7B	7B	7	7	7	7B	14	14A
CANAL ZONE	21	14A	14	7	7	7	14	14	14	14	21	21
ENGLAND	14	7A	7	7	7	7	7A	14	14	14A	14	14
HAWAII	14A	14A	14	7A	7	7B	7	7	14	14	14	14A
INDIA	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
JAPAN	14	14	14	7B	7B	7B	7	14	14	14	14	14
MEXICO	14	14	14	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
PUERTO RICO	21	14A	14	14	7	7	14	14	14	14A	14A	14A
SOUTH AFRICA	7B	7B	7B	7B	7B	7B	14B	14	14	14A	14	14B
U. S. S. R.	7A	7A	7	7	7	7B	14B	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14A	14	14	7A	7	7B	14	14	21	21A	21
AUSTRALIA	21A	21A	21	21	14	14B	7	7	7	7B	14	21
CANAL ZONE	21	14A	14	7A	7	7	7	14	14	14	21	21
ENGLAND	14	7A	7	7	7	7	7	7A	14	14	14	14
HAWAII	21A	21A	21	14	14	14	7	7	14	14	14	21
INDIA	14	14	14	7B	7B	7B	7B	14B	14	14	14	14
JAPAN	14A	14	14	14	14B	7B	7	14	14	14	14	14A
MEXICO	14A	14	14	14	7	7	7	14	14	14	14	14A
PHILIPPINES	14A	14A	14	14	14B	7B	7B	14B	14	14	14	14A
PUERTO RICO	21	14A	14	14	7	7	7	14	14	14	14A	14A
SOUTH AFRICA	7B	7B	7B	7B	7B	7B	7A	14	14	14	14	14B
U. S. S. R.	7A	7A	7	7	7	7B	7B	14B	14	14	14	14
EAST COAST	14A	14	14	7	7	7	7	14	14	14A	14A	14A

A = Next higher frequency band may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

JULY

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G/G	2 G/G
3 F/F*	4 P/F*	5 F/G	6 F/G	7 F/F	8 F/F	9 P/F
10 F/G	11 G/G	12 G/G	13 G/G	14 G/G	15 F/G	16 F/F
17 F/F	18 F/G	19 F/G	20 F/G	21 F/F	22 F/F	23 F/F
24 F/G 31 G/G	25 G/G	26 G/G	27 F/F	28 P/F	29 F/G	30 G/G

FT-77 The Rig for All Seasons!

Answering the call for an HF rig that goes everywhere, sounds great, and is cost-effective, Yaesu proudly introduces the FT-77 Compact HF Transceiver System.

Computerized Design and Manufacture

The FT-77 design engineers utilized the latest computerized circuit board layout methods, resulting in a compact, reliable transceiver with maximum utilization of available space. Automated insertion techniques are used in assembly, providing improved reliability and quality control over earlier designs.

Operating Versatility

The FT-77 is equipped for operation on all amateur bands between 3.5 and 29.7 MHz, including the three new WARC bands. Fully operational on SSB and CW, the FT-77 includes a dual width noise blanker (designed to minimize the "Woodpecker" or ignition noise), full SWR metering, R.I.T., and optional CW filter with wide/narrow selection. The optional FM-77 permits operation on the FM mode, with front panel squelch sensitivity control.

Expandable Station Concept

Ideal for mobile operation because of its compact size and light weight, the FT-77 forms the nucleus of a versatile base station. Available as options for the FT-77 are the FP-700 AC Power Supply, FV-700DM Synthesized External VFO and Memory System, FTV-707 VHF/UHF Transverter, and FC-700 Antenna Coupler, providing top performance at an extraordinarily low price.

Best of All, It's a Yaesu!

With most experience in transceiver design and manufacture, the Yaesu trademark is your guarantee of quality and durability. We've got all-new technology and an all-new warranty policy to back it up.

See the FT-77 and the all new line of Yaesu HF, VHF, and UHF transceivers, receivers and accessories at your Yaesu Dealer today! *It's time you tried a Yaesu!*

Price And Specifications Subject To
Change Without Notice Or Obligation

YAESU
The radio.

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YAESU ELECTRONICS CORPORATION, 6851 Walthall Way, Paramount, CA 90723 ● (213) 633-4007
YAESU Cincinnati Service Center, 9070 Gold Park Dr. Hamilton, Ohio 45011 ● (513) 874-3100

NEW

"DX-traordinary."

Superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

TS-930S

The TS-930S is a superlative, high performance, all-solid state, HF transceiver keyed to the exacting requirements of the DX and contest operator. It covers all Amateur bands from 160 through 10 meters, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.
Among its other important features are, SSB slope tuning, CW VBT, IF notch filter, CW pitch control, dual digital VFO's, CW full break-in, automatic antenna tuner, and a higher voltage operated solid state final amplifier. It is available with or without the AT-930 automatic antenna tuner built-in.

TS-930S FEATURES:

- **160-10 Meters, with 150 kHz-30 MHz general coverage receiver.**
  Covers all Amateur frequencies from 160-10 meters, including new WARC bands, on SSB, CW, FSK, and AM. Features 150 kHz-30 MHz general coverage receiver. Separate Amateur band access keys allow speedy band selection. UP/DOWN bandswitch in 1-MHz steps. A new, innovative, quadruple "UP" conversion, digital PLL synthesized circuit provides superior frequency accuracy and stability, plus greatly enhanced selectivity.
- **Excellent receiver dynamic range.**
  Receiver two-tone dynamic range, 100 dB typical (20 meters, 50-kHz spacing, 500 Hz CW bandwidth, at sensitivity of 0.25 μv, S/N 10 dB), provides the ultimate in rejection of IM distortion.
- **All solid state, 28 volt operated final amplifier.**
  The final amplifier operates on 28 VDC for lowest IM distortion. Power input rated at 250 W on SSB, CW, and FSK, and at 80 W on AM. Final amplifier protection circuits with cooling fan, SWR/Power meter built-in.
- **CW full break-in.**
  CW full break-in circuit uses CMOS logic IC plus reed relay for smooth, quiet operation. Switchable to semi-break-in.
- **Automatic antenna tuner, built-in.**
  Covers Amateur bands 80-10 meters, including the new WARC bands. Tuning range automatically pre-selected with band selection to minimize tuning time. "AUTO-THRU" switch on front panel.
- **Dual digital VFO's.**
  10-Hz step dual digital VFO's include band information. Each VFO tunes continuously from band to band. A large, heavy, flywheel type knob is used for improved tuning ease. T.F. Set switch allows fast transmit frequency setting for split-frequency operations. A=B switch for equalizing one VFO frequency to the other. VFO "Lock" switch provided. RIT control for ±9.9 kHz.
- **Eight memory channels.**
  Stores both frequency and band information. VFO-MEMO switch allows use of each memory as an independent VFO, (the original memory frequency can be recalled at will), or as a fixed frequency. Internal Battery memory back-up, estimated 1 year life. (Batteries not Kenwood supplied).
- **Dual mode noise blanker ("pulse" or "woodpecker").**
  NB-1, with threshold control, for pulse-type noise. NB-2 for longer duration "woodpecker" type noise.
- **SSB IF slope tuning.**
  Allows independent adjustment of the low and/or high frequency slope of the IF passband, for best interference rejection. HIGH/LOW cut control rotation not affected by selecting USB or LSB modes.
- **CW VBT and pitch controls.**
  CW Variable Bandwidth Tuning control tunes out interfering signals. CW pitch controls shifts IF passband and simultaneously changes the pitch of the beat frequency. A "Narrow/Wide" filter selector switch is provided.
- **IF notch filter.**
  100 kHz IF notch circuit gives deep, sharp, notch, better than -40 dB.
- **Audio filter built-in.**
  Tuneable, peak-type audio filter for CW.
- **AC power supply built-in.**
  120, 220, or 240 VAC, switch selected (operates on AC only).
- **Fluorescent tube digital display.**
  Six digit readout to 100 Hz (10 Hz modifiable), plus digitalized sub-scale with 20-kHz steps. Separate two digit indication of RIT frequency shift. In CW mode, display indicates the actual carrier frequency of received as well as transmitted signals.
- **RF speech processor.**
  RF clipper type processor provides higher average "talk-power," improved intelligibility.
- **One year limited warranty on parts and labor.**

Other features:

- SSB monitor circuit, 3 step RF attenuator, VOX, and 100-kHz marker.

Optional accessories:

- AT-930 automatic antenna tuner.
- SP-930 external speaker with selectable audio filters.
- YG-455C-1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in CW filters for 455-kHz IF.
- YK-88C-1 (500 Hz) CW plug-in filter for 8.83-MHz IF.
- YK-88A-1 (6 kHz) AM plug-in filter for 8.83-MHz IF.
- SO-1 commercial stability TCXO (temperature compensated crystal oscillator). Requires modifications.
- MC-60A deluxe desk microphone with UP/DOWN switch, pre-amplifier, 8-pin plug.
- TL-922A linear amplifier (not for CW QSK).
- SM-220 station monitor (not for pan-adapte
- HS-6, HS-5, HS-4, headphones.

More information on the TS-930S is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

KENWOOD

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Specifications and prices are subject to change without notice or obligation.